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2. "My name is Baker. I've only been here a year, but the jobs they give men like Stark and me are too easy. In three months I saw I could never get far ahead on routine work like this. So I began to look for ways to increase and improve the work in my department. I'm taking home-study training that's helping me a lot. My boss heard about it and complimented me. Next month I'm going to be made Assistant Department Head at 40% more money. After that—well, we'll see. But you can bet I'm still studying!"

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Position.....

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Grade School Graduate



After I had completed the College Preparatory course with the American School I was admitted to Indiana University where I made a general average of 90. I was told by my professors that I had the "study habit" and was better able to carry college work than many graduates of resident high schools. The courses given by the American School were so thorough and complete that my foundation for advanced work was adequate and strong enough to stand the tests.—**DELMORE LIGGETT**, Rising Sun, Indiana.

The man with only grade school education starts at \$400 a year, averages only \$1,265 a year over a period of 40 working years. Today no ambitious man need be chained

down to low pay by grade school education. In your own home you can get expert help and complete your high school course or prepare for drafting, Diesel, air conditioning, etc., and get ready to earn more money.*

High School Graduate



I graduated from high school in June, 1936, and in October, 1937, enrolled in your Engineering Course just a little over a year ago; and I am writing you today telling you of the wonderful things which have happened to me since that day when I enrolled. I have studied hard and consistently and according to your instructors have earned good grades and have progressed rapidly. This rapid progress has been made possible by the methods "American School" uses and the splendid manner in which your instructors handle any special inquiries or problems which may confront the student.

Very recently I did the major part of the Designing, Drawing and Detailing of a device which has been patented by one of the world's leading automotive truck manufacturers. This device is being used now by the Motor Truck Corporation and they have made the statement that it saves them \$13 on every unit they produce. I will not be 21 years of age until next Spring and expect by that time to have completed my course and have my "American" diploma which I will be mighty proud of.—**EDWARD H. MCCLELLAND**, Cleveland, Ohio.

High School graduate starts at \$900 a year, averages \$2,112 over a 40-year period. This means that *High School education to average persons is an actual cash earning of \$347 above earning of the average grade school graduate.* A High School graduate

not only has bigger jobs open to him, but he can go on to college, prepare for teaching or other professions, or for leadership in business or industry. High School education definitely increases your opportunities for advancement and your earning ability!*

College or Vocational Training



From a practical standpoint I can truthfully say that my study of the course accomplished for me all I ever hoped it could and even more. As evidence of this, I submit the fact that at 30, I am now employed as auditor and accountant in a position of trust at compensation more than double what I was receiving at the time of my enrollment.—**L. V. PEART**, Ogden, Utah.

The man with college education or some other form of specialized training starts at \$1,400 a year, is earning \$5,000 at the age of 49—or an average of \$3,425 a year. He is a leader in his community, has a good car, *Figures from Government report.

and a comfortable home. You can get ready for opportunities open to Architect, Business Manager, Mechanical Engineer, Professional Accountant, etc., through expert methods of preparation available in your own home, and get the knowledge that will open the way to the higher paid jobs!*

Mail the Coupon for a Free Lesson

Applicants—

Definite Promotion Step

Step Up to a Better Job by Stepping Up Your Fitness for It

You think in words but you cannot think, write or speak in words you do not know.

How about your job? What you think and do is limited to things you know. Every new task or operation—every new job—is a new lesson to be learned, and your grading on that lesson definitely measures your efficiency. You should make it your first order of business to learn everything you possibly can about your present job. Do not be satisfied with just getting by. Become the best informed person on that kind of work in your office or plant.

Next consider the job ahead. Study up on the principles of the new work. Learn all you can about it so when there is an opening and you are offered the chance to step up you will be prepared to make good. All of us are on trial at all times.

Don't Be Handicapped

There are jobs and opportunities today in such active fields as Air Conditioning, Diesel, Drafting, Accounting, Merchandising, etc. *These jobs—these opportunities—are open only to trained men.* That's why thousands of ambitious men are taking American School's courses—are spending a few hours a week getting ready to earn more money.

American School graduates hold important positions as architects, engineers, accountants, superintendents,

draftsmen, foremen, managers, etc., or successfully operate their own business. Hundreds of our High School graduates have entered colleges, universities, normal schools, etc., have attained success in business and industry.

Without obligation send for a beginning lesson. Spend an evening reading it and you will be surprised at how much you can learn in only one hour. You will find out how other fellows are making good—earning promotion.



Try a Lesson Yourself—No Obligation

American School, Dept. G-646, Drexel Ave. at 58th St., Chicago

I have checked the line of work in which I would like a good job. Please send me without expense or obligation on my part a copy of your Bulletin and an early lesson in the field I have selected.

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Name..... Age..... Occupation.....
Street..... City..... State.....

Our Readers Say



What This Country Needs Is a Good Cigarette Pack

EVERY once in a while, some one comes out with a bright idea for a new cigarette case. But it seems to me that all this ingenuity is

WAN, THEY'RE ONLY MEANT TO SOLVE THE PROBLEM OF THE MOST USELESS PRESENT!



wasted because, in general, people do not want to mess around transferring cigarettes from a pack to a case. Cases have been devised to hold an entire pack of cigarettes, but these prove rather bulky. Besides, when a few cigarettes have been removed, the pack collapses and the rest are crushed. Why doesn't some company bring out a "flat 50's," only smaller? Such a package would be about two and three quarters inches wide, five inches long, and the thickness of one cigarette. I think smokers would welcome such a pack.—L. T. K., Buffalo, N. Y.

He'd Like To Coast Home from Bicycling Trips

How about some plans for running a bicycle with an electric motor? Just as an idea, an automobile starting motor might be used, with a good storage battery mounted on a rack over the rear wheel to supply the juice. If this wouldn't be practical, I don't know why not. The battery and starter of an automobile, if they're both in good condition, will propel the average low-priced car a good part of a mile, I've been told. Remember, this means dragging a dead motor, too. The greatly reduced "load" of a bicycle, with corresponding decreased current consumption, ought to make this an ideal power plant for propelling a bike on marketing trips and other short errands. Geared to the coaster-brake sprocket, the motor would be a free-wheeling unit on hills, and by addition of a simple clutch, the motor could be disengaged to let the rider pedal on level stretches. A home-type battery charger, such as many motorists keep in their garages, would "refuel" the battery when needed.—F. H., Teaneck, N. J.

PUT A GENERATOR ON AND CHARGE THE BATTERY WHILE PEDALING!



Something Tells Us He's Pulling Our Leg

YOUR reader D.A.M., of Ottawa, Canada, who suggests scientific tests of old saws and proverbs, apparently has not heard of the work of my distinguished friend, Prof. Aristide D. Addepate and his Bromide Testing Laboratory. It has been my privilege to be associated with Professor Addepate in many of the revolutionary experiments in which he applied scientific measurements to time-honored sayings. I was present, for example, when he demonstrated to a gathering of famous savants that a stitch in time really saves only 8.438, and that a miss is as good as 5,572 feet. On another memorable occasion, he established the fact that a bird in the hand is worth from 1.997 to 2.186 in the bush, depending on the kind of bush.—P. L. V., Cambridge, Mass.

The Flowers That Bloom in the Spring Grow Faster When Orchestras Swing

JITTERBUDS! That's the latest in swing music. According to my evening newspaper, scientists have discovered that when rose buds are

YOU SAID IT, SWING DOES SOMETHING TO EVERY BODY!



placed near an orchestra, they will open more rapidly than when placed some distance away. Swing music does something to them. The research men believe the explanation lies in the fact that the tenseness of the plant cells is affected by the loudness and pitch of the music. Sound waves may affect the plants just as sunshine causes a sunflower to turn toward the source of light. Florists one of these days may be putting phonographs or radios in their greenhouses to speed up the lagging blooms!—H. T., Brooklyn, N. Y.

Inventor of the Windmill Had Brains—and Used Them

YOUR recent article on windmills suggests a fascinating question: How did they happen to be invented? What unsung genius centuries ago combined two still earlier inventions—the wheel and the sail—to produce the first windmill? And what led him to try it? It's easy to guess at the origin of other great inventions of ancient times. (Continued on page 14)

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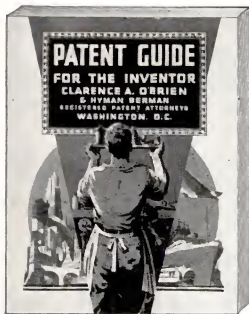
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Our Readers Say (CONTINUED)

A primitive woodsman might have sensed, in a flexible sapling that snapped back in his face, the power that could be harnessed in a bow to drive an arrow. A camp fire glowing on a bed of ore might accidentally have led to the discovery of how to smelt iron. But nothing in nature, that I can imagine, could have suggested the idea of a windmill.—H. W., Pittsburgh, Pa.

He's Looking at the World Through Magnifying Glasses

AIN'T THERE LOTS OF WONDERFUL THINGS AROUND US, RADIOS, TELEPHONES, AND EVERYTHING, GOSH!



INSPIRED by your excellent articles on amateur microscopy, I recently bought a sixty-power pocket microscope to carry around with me for examining flowers, insects, and other things that come in my way. The other day, I was looking at the stamens of a tiny wild flower, when I was surprised to see an insect come

creeping out of it. Under the microscope it looked as big as a horse, while to the naked eye it was just a speck that would hardly be recognized as a living creature. The glass plainly showed its eyes, legs, and feelers, and I watched its contortions as it struggled through the loose fibers of a piece of cloth. It made me realize the wonders that are opened to us by optical instruments—on the one hand the telescope which shows us countless solar systems besides our own, on the other the microscope which reveals world after world of the infinitely small. Gosh!—L. B., Poughkeepsie, N. Y.

Even the Button Bag Shelled Out for This Reader's Experiments

BEING an ardent reader of P.S.M., I look forward to each month's issue packed full of new reading. The first things I read are the microscopy and the chemistry articles. They are really swell. I hope you will continue them forever and a day. After reading "Looking at Shells with Your Microscope," in the July issue, I wanted to get started immediately. But since I do not live near any rivers, streams, or lakes, and all the souvenir shops were closed at that time, I thought I was out

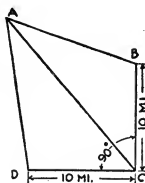
I DON'T SEE HOW BAXTER LOSES SO MANY BUTTONS AND ALWAYS THE PEARL ONES!



of luck. Then I recalled reading that many buttons were made from sea shells, so I collected all the buttons in the house and took a squint through the magic lens of my microscope. Sure enough, on many of them I found all the details described in Morton C. Walling's article.—W. N., Muncie, Ind.

Here's One To Make the Boys "Scratch Their Heads a Little"

HAVE enjoyed monkeying with the problems you print, for the last couple of years. Here's one that may make the boys scratch their heads a little: A man always drives at the same speed (his car probably has a governor on it). He makes it from A direct to C in thirty minutes; from A through B to C in thirty-five minutes, and from A through D to C in forty minutes. How fast does he drive?—D. R. C., Sacramento, Calif.



Something Should Be Done To Keep the Neighbors Quiet!

IN answer to F.M.W., who was having trouble with his neighbors because of a Tesla coil that interfered with their radios, I suggest that he either add plates to his condenser, or subtract a few, thereby tuning the coil to a frequency not used by local radio stations. By adding plates, he will also increase the voltage.—R.A.K., Elgin, Ill.

—And Can Anyone Answer the Riddle of the Sphinx?

AS AN amateur student of psychology, may I suggest a few marked points of difference between the male and the so-called weaker sex, from my notebook of observations? Perhaps they may be put in the form of questions: Why does a woman seem constitutionally unable to replace a screw cap on a bottle of ink, a jar of cream, or tube of toothpaste? Why do two or more women invariably choose a busy and constricted passageway, such as a narrow corridor or a doorway, for extended conversation and *(Continued on page 16)*

AND HOW DO THEY FIND SO MUCH TO CHATTER ABOUT ON THE PHONE?





IF you're that man, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn't it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period in your life? Always provided that the rewards were good—a salary of \$2,000 to \$10,000?

An accountant's duties are interesting, varied and of real worth to his employers. He has *standing!*

Do you feel that such things aren't for you? Well, don't be too sure. Very possibly they *can* be!

Why not, like so many before you, investigate LaSalle's modern Problem Method of training for an accountancy position?

Just suppose you were permitted to work in a large accounting house under the personal supervision of an expert accountant. Suppose, with his aid, you studied accounting principles and solved problems day by day—easy ones at first—then the more difficult ones. If you could do this—and if you could turn to him for advice as the problems became complex—soon you'd master them all.

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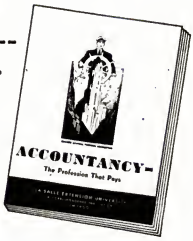
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Our Readers Say

(CONTINUED)

farewells? What impels a woman to transpose the sheets of a newspaper that you haven't read yet, so that page three is where page twenty-seven ought to be—if she hasn't gone so far as to mangle the paper beyond all recognition? Perhaps other readers may have additional items to suggest—and the ladies, God bless 'em, may have a few comebacks of their own!—P. R. B., Boston, Mass.

It Might Be a Good Idea To Keep a Gas Mask Handy

THE idea of sending post cards aloft with hydrogen balloons, described by one of your readers in a recent issue, has me interested. I've tried to do it, but can't seem to get enough pressure to fill the balloon. Could you suggest a good method?—D. F., Windsor, Ontario, Canada.

... I discovered that you do not have to fix up apparatus (if you haven't already got it) to get a gas that will lift your balloon. Just squeeze the neck of the balloon over an ordinary gas jet and turn on the gas. One disadvantage of city gas is that the pressure may not be enough to blow up a new balloon. You may have to keep it blown up with air overnight to make it stretch easier. Your magazine is leading the list of its kind. Let's have some more "dope" along the radio and photography lines.—M. P., Canoga Park, Calif.

IF IT'S SO IMPORTANT,
THE SOLUTION OUGHT
TO BE EASY!



This Should Bust the Debate Wide Open

MAY I bust in on one of your debates? P.R. is quite right: The human eye is not of fixed focus. The functional lens consists of two parts, the inner of which changes shape to adjust for distance. At long range, this "crystalline lens" which is an elastic, jellylike ball, is flattened and made optically weaker by the outward pull of a small, circular ligament. For close-up focus, a small circular muscle pulls against the ligament and takes the strain off the lens, which then rounds up like a rubber ball, and becomes optically stronger. Some animals, such as birds, can shorten the eyeball to focus. Certain fish can move a back lens. But humans use neither of these methods. In shifting from distant to close-up vision, three things occur: *Convergence* of the eyeballs so that they point at the same object and place its image on corresponding parts of the light-sensitive parts of both eyes; *constriction* of

the pupil by the iris to "stop down" excess light and increase depth of focus and sharpness; and *focusing*, as explained above. By the way, a person normally sees everything double, except the one thing he is looking at.—R. J. B., Little Rock, Ark.

His Local Radio-Parts Dealer Is the Man for Him To See

Most, or I should say all, of the articles on radio-set construction that you publish have photographs showing that they have actually been built. I think that a valuable addition to these articles would be estimates of the cost of each of the sets. This would help us readers decide whether we could afford to build the sets.—W. P. V., Trenton, N. J.



One of Those Four Torpedoes Might Head for a Friendly Ship

THOSE four-way, aerial, bomb torpedoes on page 44 of the August issue are fine, but isn't there danger that those that miss the enemy ships might hit our own?—M. I., Erie, Pa.

Information from One Who Knows on the Subject of Water in Tires

MAY I offer another answer to W.R.S. on the subject of inflating tires with water? It is done very extensively with tractor tires, which are filled from half to two thirds full of water, then pumped up with air. Adapters can be bought for the tire valves. Incidentally, I've had water in my tractor tires for two and a half years. Antifreeze of the right kind can also be put in them, I understand, though we don't use it in this part of the country where the temperature doesn't get down to freezing. I find that the water actually provides a shock-absorbing action to my tractor wheels. It gives them added weight for better traction, and, because the volume of air is smaller, the tires are easier to pump up. And when they go flat, they go down slower. I think I'll try it in my auto tires for the fun of it.—G. R. C., McAllen, Tex.

WHO SAYS WATER IN THE TIRES AIN'T SOMETHING?



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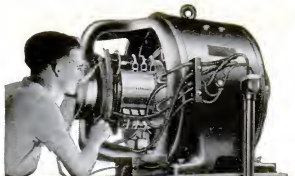
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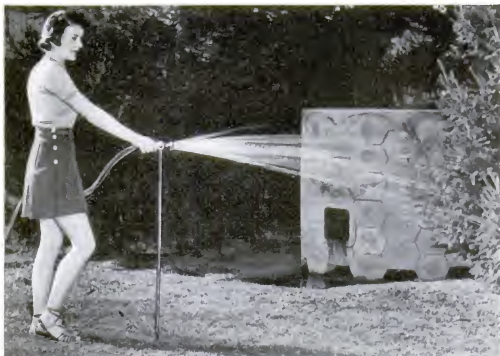
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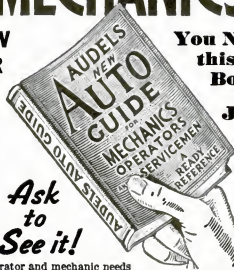
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HOW WILLARD SAFETY-FILL WORKS



To fill the battery, unscrew filler-cap as usual.



Place cap on SAFETY-FILL forming air lock in breather chamber.

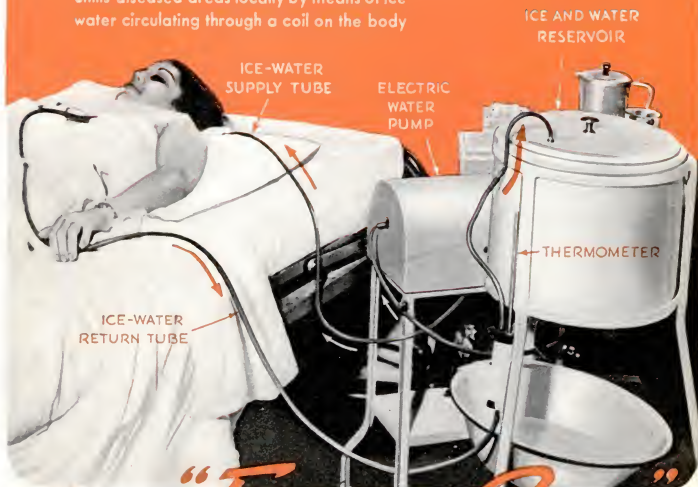


Fill well with water. Air lock prevents solution rising above bottom of well.



Remove filler cap from the SAFETY-VENT and solution drops to correct level.

A forerunner of the new artificial hibernation, this odd "refrigeration treatment" chills diseased areas locally by means of ice water circulating through a coil on the body



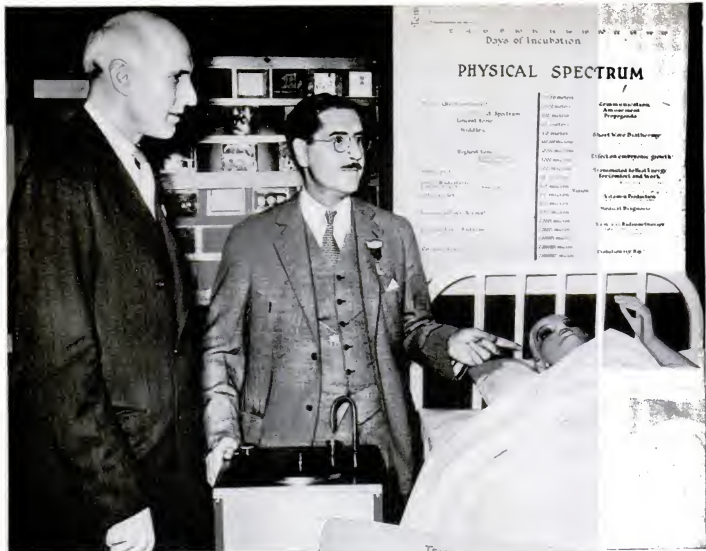
“Frozen Sleep Cure Cancer?”

FROZEN SLEEP," an amazing treatment in which human beings slumber as if hibernating, has just been introduced to the startled medical world. Before physicians assembled at a recent American Medical Association convention in St. Louis, Mo., Dr. Temple S. Fay and Dr. Lawrence W. Smith of the Temple University School of Medicine described an experiment that might

well have taxed the credulity of their listeners, if it had not been supported by an actual movie of the scientific drama.

Lying on beds in the Temple University Hospital in Philadelphia, nude women were packed in ice like frozen fish. Electric fans played upon them. Their eyes closed and the last sign of consciousness flickered out. To all appearances they were lifeless. Their

By ALDEN P. ARMAGNAC



Dr. Lawrence W. Smith and Dr. Temple S. Fay demonstrating their radical method of treatment with a dummy. Chart at right shows a patient's temperature in a test

internal temperature had been forced down from a normal 98.6 degrees F. to below ninety degrees, far past the minimum at which it had been thought possible for anyone to survive.

Their organs of digestion and elimination ceased working. No matter; for their blood, analysis showed, no longer was filling with waste products to eliminate. Their pulse beat apparently had vanished. Only when an observer applied a sensitive electrical device called an electrocardiograph was the slightest sign of life discernible. The instrument showed that each subject's heart was still beating faintly, with a slow, gentle rhythm.

For five days the "frozen" women slumbered in their icy chamber, as bears might hibernate in their caves. Then experimenters brought them back to consciousness with hot applications and steaming coffee. The subjects awoke smiling and refreshed, as if from



a deep, dreamless sleep. There had been no feeling of pain, they reported, but only an agreeable sensation of sleepiness as they were "frozen." Of their five-day coma, they had no recollection.

The thirty-two women who submitted to the daring experiment were suffering from hopeless, "inoperable" cases of cancer. What the experimenters hoped was that the drastic

freezing treatment might check the spread of the disease, much as the cold of an ice box halts the growth of organisms that spoil food. Not once, but repeatedly, in intermittent stretches totaling as many as forty days over a period of several months, the volunteers were kept in "frozen sleep." Some of the subjects were chilled to an internal temperature of eighty-nine degrees, it was reported; one patient, for a brief time, to as low as eighty-two degrees. Results seemed almost too good to be true.

The women gained weight. Their appetite improved. Their pain was relieved. They began to feel new interest in living. Within twenty-four to forty-eight hours, tumors were rapidly shrinking. Even previously "intractable" lesions began to heal, and with two of the subjects disappeared completely. As the experimenters had foreseen, there were relapses—fatal after several months to some of the patients in advanced stages of cancer, who soon would have died in any event. But in other cases the recurrence of the disease was longer delayed, and less severe when it did occur, than after any treatment applied heretofore.

So new are the experiments that no one knows, as yet, how long frozen sleep may prolong the lives of "hopeless" patients—or what permanent benefits it may have for patients in less advanced stages of cancer. Hence the experimenters make it plain that they claim no cancer "cure" at this point in their studies. Rather, they cautiously describe their amazing treatment as "a useful, important, and significant adjunct in the treatment of cancer," especially in conjunction with standard X-ray therapy.

Other physicians, viewing the movie that told the story of the experiments, were less restrained in their comments. Not only for treating cancer but for all manner of other ailments too, they predicted, the frozen-sleep treatment may provide medicine with

These are actual scenes from the movie of a test in which a patient was kept in frozen sleep for days



Period of "hibernation" resembles sleep. Slight voluntary movement occurs. Patient cannot be roused to consciousness but reacts to pain. No recollection of four day episode following return to consciousness.



E. C. two days following "hibernation" treatment shown above. During "hibernation" there is complete cessation of kidney function and no bowel activity. Patient recovers from this state with increased appetite and improvement in general state of well being.



Fish have been frozen into solid cakes of ice and then revived, apparently unharmed. Here Dr. A. N. Baradin, of Harvard University, is examining an Alaskan blackfish that has had this rare experience

Dr. Alexander Gaetz, seen below with his wife who assists him in his experiments, has succeeded in keeping primitive forms of life in temperatures as low as 300 degrees below zero for as long as 100 hours



a new tool of incalculable value in many ways.

It might be applied, some suggested, to patients affected with heart trouble. No other form of treatment, they pointed out, could give the heart such a complete rest.

Frozen sleep, others suggested, might replace "insulin shock"—a drastic but effective method applied during the last year—for treating certain kinds of insanity. In the insulin treatment, the drugged patient collapses in a deep coma, which is believed to have an important part in the cure. "Freezing" the patient into a coma might have as beneficial results with less severe physical reaction.

Could germ diseases, too, be cured with frozen sleep? This might be possible if, for any given germ, there were a temperature close enough to that of the human body at which it would be killed or its virulence destroyed. Already it is known that certain germs can be fought successfully by artificially elevating the body's temperature a few degrees, in a "radio fever machine." Depressing the body's temperature might turn out to be as effective for treating tuberculosis or other ailments. Even if the germs were not destroyed within attainable temperatures, they might at least be checked to a greater extent than the growth of "repair tissue," giving the body time to recuperate and gain

reserves of strength in the battle for recovery.

These and other medical possibilities of frozen sleep will have to be checked and rechecked, in countless experiments, before its practical applications will be fully known. But to the biologist, meanwhile, it has a more immediate fascination. For it seems the nearest approach on record to hibernation, or suspended animation, among human beings.

When animals hibernate, their pulse seems to vanish; respiration almost stops; and, even among warm-blooded animals, their temperature drops very nearly to that of their surroundings. Until now there has been little evidence that human beings could do likewise, and that little has been clouded in mystery.

By an effort of will, the yogis of India are said to be able to pass into trances, in which life processes all but cease. Sleeping sickness and catalepsy provide more familiar examples of a disordered state resembling suspended animation. Again, Russian peasants have been reported to resort to a sort of "hibernation sleep," huddled together for warmth beneath piles of furs, to pass the winter in times of famine.

But placing human beings artificially in a state of suspended animation has so far been reserved for writers of fiction thrillers—who may take literary (*Continued on page 220*)



Electric Eyes Gauge Speed of Baseball

How fast can a baseball player throw a ball? A portable machine that answers this question was tried out recently at Cleveland, Ohio. Hurling into a tunnel, the ball cuts across two light beams aimed at photo-electric

cells, and a mechanism registers the speed by a light flashed onto a vertical scale. Bob Feller, Cleveland pitcher, threw a ball at the rate of about seventy-five miles an hour in a test with the machine.

Meter Tests Car Brakes at Scene of Accident

ON-THE-SPOT tests of the brakes of automobiles involved in accidents are now being made by police authorities with the aid of a deceleration meter that shows how quickly a car can stop after its brakes are applied. Working on an inertia principle, the instrument is clamped to the running board of the accident car, which is then driven at a given speed and the brakes suddenly jammed on. A scale on the decelerometer indicates whether the brakes are weak or out of adjustment.

"Finger" Speeds Dialing



EASILY attached to the top of a dial-telephone receiver, a metal finger now on the market fits snugly into the dial holes, helps prevent inaccurate dialing, eliminates the danger of broken finger nails, and speeds up the dialing process by about ten percent.



Clamped to the running board of a car involved in an accident, this handy unit checks up on its brakes

Horses Can't Back Out of New Barrier



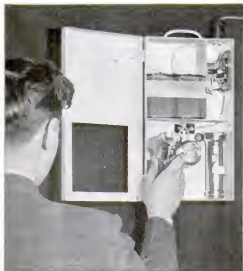
TO INSURE a fair start and to eliminate long delays, a new starting barrier for horse races has just been developed and put through a series of preliminary tests at the race course at Inglewood, Calif. Although somewhat similar to padded-stall barriers now in general use, the new model has a bar at the back of each stall to prevent horses from backing out, and also double hinged gates at the front, which swing open automatically when the starting bell sounds. The invention will eliminate the need for grooms or assistant starters to hold the horses in place.



Testing the new race-track starting barrier that dispenses with the need of grooms to keep horses from backing up

Emergency-Light Chest for Ships

DESIGNED especially for use on shipboard, an emergency-light cabinet recently placed on the market provides a source of illumination in case a ship's electric supply fails during a severe storm or a fire at sea. Battery-operated, the unit is connected to the ship's lighting circuit, an electromagnetic switch controlling the emergency light being kept open by the normal current flowing through it. When the vessel's electricity fails, the switch automatically closes, turning on the emergency light, which is covered by a window of plate glass. Two removable flash lights are housed in the cabinet for the use of occupants of the cabin. A heating coil keeps the interior of the cabinet dry.



Pipe Has Metal Stem

NOT satisfied with any conventional pipe, Prof. F. K. Kirsten, of the University of Washington in Seattle, engineered the new pipe shown above. Although the bowl is of ordinary briar, the stem is of aluminum alloy, ribbed to radiate heat and lined with machined traps to catch condensable materials in the smoke.

Pay-Roll Holdup Alarm Works Three Ways

EQUIPPED with a built-in siren audible a mile away, a carrying case for bank messengers, pay-roll carriers, and others who transport valuables from place to place, has three separate switch connections to set the electric alarm for various conditions. One switch, when set, causes the alarm to sound whenever a messenger releases his hold on the bag handle. A second, used when the bag is carried in an automobile, causes the siren to sound when the case is lifted from the floor. A third actuates a timing device, making the alarm go off automatically if the bag is left unattended for a stated period.



Trouble awaits the holdup man who tries to snatch this case. The built-in siren, seen at right, is audible for a mile away

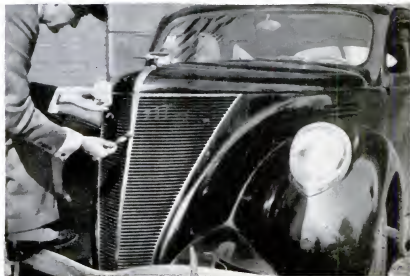


Engineer Builds Baby Walker

TO TEACH his young son to walk, a Swiss engineer built the curious apparatus shown above. Pairs of wooden arms are strapped at one end to the infant's legs and at the other to the legs of an adult, so that the latter can control the baby's leg movements. A harness connected to a pulley on an overhead wire holds the child upright while it is taking its first steps.

New Liquid Cleaner Brightens Up Metal

DOING its work by chemical rather than by abrasive action, a liquid compound recently placed on the market is designed to simplify the cleaning of metal surfaces. A thin coat is brushed onto the soiled metal surface, wiped off with a wet rag, and then dried. According to its manufacturers, the chemical will remove grease, stains, and tarnish from copper, brass, bronze, and other metals almost immediately, leaving no powdery deposit or other residue in cracks.



A thin coat of the liquid polish is brushed on the metal surface



A forester about to brand a deer. The rubber-tipped arrow, previously dipped in paint, will leave a mark

Foresters Brand Deer with Bow and Arrow

CARRYING bows and arrows instead of lassos and branding irons, game wardens of the Colorado State Fish and Game Commission in cooperation with the U.S. Forestry Service are marking deer and elk that roam from one feeding ground to another in

a game preserve near Sapinero. The arrows, however, are not pointed. Instead, they are tipped with sponge-rubber balls an inch and a half in diameter which bounce off the animals harmlessly as they are shot from bows in the hands of the wardens. Dipped in ordinary

sheep-branding paint, the rubber balls leave large daubs of paint of the desired color on the animals' coats. Later, watchers stationed in the near-by ranges can instantly determine the original feeding grounds from which any animals have wandered by the color of their paint brands. Reports on the animals' wanderings are helping to solve problems of their redistribution to prevent overpopulation and spread of disease, as well as to simplify the task of feeding them. Frequently, the wardens brand several animals with one shot into a herd.

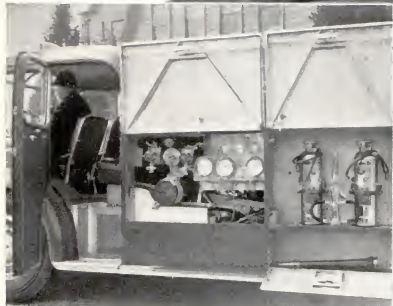


Found stuck in the snow, a fawn is branded by hand

Firemen Ride Inside Fast New Engine



New-type fire engine contrasted with one of conventional design. Six firemen can ride in the roomy, air-conditioned cab in front



View of driver's seat inside cab, and side compartments for hand apparatus. Right, pumping 1,250 gallons of water each minute

SLEEK and efficient, a streamline fire engine recently demonstrated in a Pacific Coast tour is expected by its maker to set the style for the apparatus of the future. Placing the full-vision cab ahead of the front wheels has shortened the thirty-nine-foot turning radius of a standard machine to only twenty-seven feet. A 211-horsepower "pancake" engine, of flat design with pistons moving horizontally, powers the pumper amidships; and four discharge ports deliver 1,250 gallons of water a minute at the maximum pumping pressure of the apparatus. Instead of clinging perilously outside, six firemen ride in comfort in the heated and ventilated interior, as the engine speeds along at sixty-five miles an hour.



Bathing Cap Supports Swimmer

WHEN an air chamber at its back is inflated, a new bathing cap will support the head of the wearer above water. Especially suited for children and adults who are learning to swim, the novel aid enables a beginner to practice the strokes without encumbrance or artificial support, but removes all fear. It also helps swimmers in case of cramps.



An inflated chamber keeps swimmer's head always above water



Midget Electric Steamer

NO LARGER than an ordinary fruit jar, a pocket-size electric steam plant just perfected by Westinghouse research engineers produces superheated steam from cool tap water in fifteen seconds. Plugged into an outlet and connected to a water supply, the Lilliputian steamer is expected to prove valuable as a sterilizer in barber shops, restaurants, and the offices of physicians and dentists.

Clamps Speed Removal of Aluminum Engine Heads

OPERATING on much the same principle as ice tongs, a garage tool now on the market is said by its manufacturers to make the removal of aluminum cylinder heads of automobile engines safe, sure, and easy. Gripping the thick outside edge of the cylinder head, the jaws of two adjustable clamps are tightened to force the head away from the block.



When the screws are tightened, the two tonglike clamps pry the aluminum head loose from the block

Playing Nurse to 13,000 Terrapin Is His Odd Job

PLAYING nursemaid to hordes of baby diamond-back terrapin is the odd occupation of Capt. Charles Hatsell, of Beaufort, N. C. Employed by the U. S. Bureau of Fisheries, which maintains a laboratory at the site, Hatsell's job is to raise and care for small terrapin to repopulate the Carolina coastal area with this succulent species of turtle. This year, 13,000 baby terrapin were carefully nursed through the winter and then turned loose in swamps and lagoons along the shore.



Capt. Charles Hatsell setting free some of his charges in a coast swamp land

Climbers Use Odd Exerciser

MADE like a rungless ladder with adjustable sides that can be moved apart or brought closer together at will, a novel exerciser recently constructed was designed especially for mountain climbers. Straddling upward between the side-pieces, climbers obtain useful practice for mounting the narrow gaps and crevices they meet in a real climb.



Climbing a mountain crevice, as at the left, is easy after you have practiced on this exerciser. The positions of the walls can be adjusted



Turning a knob at the end of the index brings the various machinist's tables into view for reference

Tiny Automatic Data Rule Is Handy for Mechanics

DESIGNED for mechanics, draftsmen, tool-makers, and home mechanics, the compact mechanical index pictured at the left supplies a mass of information on tapers, angles, pipe threads, decimal equivalents, and other data. Twisting the handle moves an inclosed printed tape, bringing the required information into view through a window in the aluminum case. The case also is available with blank paper.

New Safety Glass for Cars Rolls Up When Shattered

GLASS so free from splintering or shattering that, when broken, all its pieces remain in position so that the glass sheet can be rolled up like a carpet, as pictured at the right, is a new and startling improvement in safety plate glass for automobile use. Developed by the research staffs of five American firms, the product is made by sandwiching a sheet of a new plastic material between two thin panes of plate glass. When the glass is broken, all of the fragments cling to the center plastic sheet. So elastic is the new safety-glass core that it can easily be stretched to double its normal length, as demonstrated in the photograph at the extreme right. In cold weather, the new glass gains added strength.



This elastic plastic core for safety glass enables a shattered pane to be rolled up like a carpet, at left

Pipe Comes Apart for Cleaning



A KNOCK-DOWN smoking pipe recently placed on the market can be taken apart in a few seconds, permitting a thorough and easy cleaning of the stem and bowl to remove collected moisture and condensed tobacco-smoke residue. Finger pressure against the pipe bowl slides it free from the stem, which then is separated into two units that may be washed off in water or cleaned with a piece of cloth or soft paper.



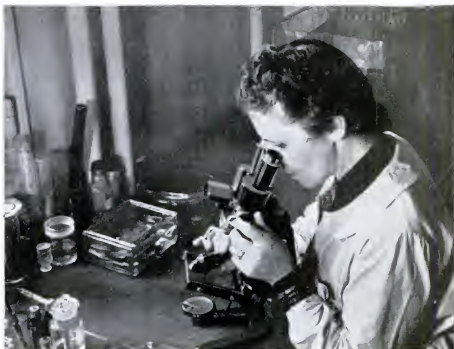
Electric Polish Drier Speeds Manicure

AN ELECTRIC drying machine now available for beauty-shop use reduces from fifteen minutes to less than three minutes the time required to dry newly applied nail polish after a manicure. When the fingers of a customer are placed in the grooved hand rest of the device, the lid is lowered, heater bulbs are switched on, and a fan blows warm air over the nails.



With the pipe bowl removed, the stem separates into two parts

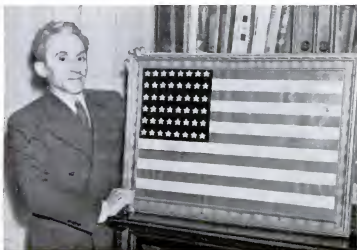
Sick Tropical Fish Get Hospital Care



Microscopic examinations of tissues show what killed a "patient." At left, operating on a fish to remove a tumor, and treating a "skin" ailment with disinfectant

A CLINIC and hospital for tropical fish has recently been established by French authorities in a Paris museum. Here, in a specially equipped laboratory, experts diagnose the ailments of pets brought in by fish fanciers, and effective curative treatments are developed and tried out. Skin fungus, the most frequent disease of fish, is said to be cured by short treatments with ultra-violet rays, followed by a bath in a weak chemical solution, but in some cases tumors and other growths have to be removed by surgical operations. Since these have to be performed out of water, they must be interrupted every

few seconds, and the fish replaced in the water to revive them. Curiously enough, the hospital directors state, fish are sometimes afflicted with the typically human complaint of indigestion. This is cured by placing the ailing patients on a special diet for a period of several days. When a fish does not respond to treatment and dies, its body is carefully dissected and examined in order to determine the precise cause of death, and thus open the way for more effective methods of treatment when a similar case is diagnosed. The work of the fish hospital is expected to provide a mass of data on the treatment of ailing tropical fish for the benefit of fish lovers, for whom there has heretofore been little information available on the treatment of the diseases that attack their pets.



John Ousta with one of his flags made of domestic silk

"All-American" Flags Made from U. S. Silk

WHAT are said to be the first all-American silk flags ever made are being produced from silk obtained from worms bred, hatched, and raised in the home of John Ousta, of New York City, who has long been promoting American cultivation of silkworms (P.S.M., Aug. '36, p. 25). Reeled on a machine which Ousta devised (P.S.M., May '38, p. 56), the silk was spun into cloth and made into U. S. flags in a Paterson, N. J., factory. The flags are being distributed to patriotic organizations and Government officials.

Malcolm W. Rix at work on a model of a tern. At the right is his reproduction of a male passenger pigeon. This is an extinct species



Brass Feathers Make Fine Birds



This plaster mold was used to cast the feet of a Labrador duck in white metal, using as models the carved walnut feet of a museum specimen

SO SKILLFULLY made that they are difficult to distinguish from the finest examples of the taxidermist's art, bird models made with brass, white metal, and wood as the basic materials are the products of the unusual and interesting hobby of Malcolm W. Rix, of Schenectady, N. Y. Growing out of an early boyhood interest in birds, Rix's hobby began when he first attempted to whittle reproductions of birds from wood. Not satisfied with the results, he adopted more painstaking and precise methods to model his favorite species, such as the bobwhite quail. At the suggestion of a friend, an ornithologist, he became interested in extinct species, and now plans to devote all his modeling activities to birds no longer in existence. Already he has completed



By WALTER E. BURTON

models of the extinct passenger pigeon and the Labrador duck.

Rix carves the bodies of his model birds with a pocketknife, from either pattern-maker's pine or mahogany, shaping them carefully, following the exact contours of a museum specimen. These contours are obtained with an ingenious shadow box, in which a specimen is arranged in front of a ground glass so that a projected light throws a shadow outline of the bird onto the glass. This he traces and transfers to paper or cardboard for use as a template or pattern. With the body completed, including such details as eyes and breast feathers, he fashions the feet and bill of white metal, an alloy, and makes the tail and wing feathers of sheet brass. After the various parts are assembled, he starts the exacting job of coloring the model to make it true to life. At present, his collection includes two blackcap chickadees, a pair of bobwhite quail, a common tern, two passenger pigeons, and a male Labrador duck. Although he makes his models solely for pleasure, Rix's growing group of extinct-bird models undoubtedly will have considerable scientific value in the future.



Attaching brass tail feathers to a model of a flying tern. Rix is seen above with some of his models, including blackcap chickadees, bobwhite quail, passenger pigeons, a Labrador duck, and the flying tern

How Will the World End?

WHAT will the end of the world be like? In the Fels Planetarium of the Franklin Institute at Philadelphia, recently, thousands of persons witnessed a preview of this spectacle, the most gripping that man will ever see. "Canned" sound effects from great electrical storms added realism to the thrilling images of cosmic cataclysms thrown on the planetarium dome by a giant projector to dramatize four possible ways in which life on our planet may be destroyed—by burning, collision, freezing, and explosion. Paintings reproduced in these pages show the tragic scenes they suggest.

Sometimes a star becomes a "nova," or mysteriously flares up in brightness. Suppose that suddenly our own star, the sun, should likewise act as if a vast bellows were blowing a draft into its molten interior. In eight brief minutes the resulting blast of radiant heat would reach the earth, and all life on this planet would vanish in clouds of steam and puffs of smoke. Fortunately, however, the chances of such celestial fireworks are remote. The sun probably was a nova when the solar system was born and is unlikely to repeat the performance.

Instead, however, the sun might undergo only a twofold or threefold rise in temperature, as astronomers have seen happen to a star in the constellation of Cassiopeia. A few more degrees here would bring a slower but no less inevitable end. Polar ice would melt, and the ocean would rise 200 or 300 feet, destroying great coastal cities. The rising temperature would draw more moisture into the air. Constant storms would rack the world. Finally life would succumb to the steamy, superheated atmosphere.

When the planetoid Hermes whizzed past the earth in October, 1937, it suggested another accidental way that at least a large part of the world's population may be wiped out. A newly discovered stray from a remote cluster of "baby planets," Hermes missed us by the uncomfortably close mar-

gin of less than 400,000 miles, or not much more than the distance to our own moon. Traveling at 70,000 miles an hour, the sky projectile was less than six hours' flight away from us at its nearest point! It was the earth's narrowest escape from a major crash in the history of astronomical observation.

Hermes ranks as one of the smallest of the known planetoids, measuring only a mile or so in diameter, and the earth might suffer little more than a violent jolt if the baby planet hit an uninhabited land area. In case it landed in an ocean, however, devastation by tidal waves would be appalling. And if it struck a crowded metropolitan area, the toll of life would equal that of a world war. People that it missed would still be threatened, not only by terrible earthquakes, but even more by a searing air blast of hurricane velocity that would mushroom out from the point of impact. Acting as a piston to compress the atmosphere against the earth's surface, the planetoid would heat it like air in a tire pump, scorching to a crisp anything in the vicinity.

Such a phenomenon was observed on a smaller scale in 1908, when a swarm of meteorites—really the head of a small comet—struck the earth (Continued on page 222)

BURNING. If the sun grows hotter, life will perish in the superheated atmosphere





COLLISION. A giant meteor, running wild through space, may strike the earth and create havoc with its impact and scorching breath.

EXPLOSION. The moon draws nearer the earth, raising enormous tides and unleashing the inferno seething beneath its crust.

ILLUSTRATIONS BY B. G. SEIELSTADT



FREEZING. As the sun burns out, ice will cover the earth and men will shiver around fires in dark caverns.





How scribes of Babylon 4,000 years ago wrote letters in clay. The ancient fitbit of business correspondence above contains an offer of a bribe to the tax collector



MODERN SCIENCE DECIPHERS

Ancient Love Letters

FOUR THOUSAND years after a man wrote a love letter, a bookkeeper, a chemist, and a scholar got together and deciphered the missive of adoration.

Sounds crazy, doesn't it? But that's exactly what happened. The story goes like this.

Ever since scientists began digging up the contents of Babylonian wastebaskets, they have been trying to work out some simple system for preserving and deciphering this ultrapersonal correspondence.

Of course, the secret of cuneiform writing on clay tablets, with its odd-looking, wedgelike marks, was discovered years ago, but that was just the beginning of trouble for the archaeologists. In the first place, the clay tablets were likely to be ruined be-

fore they could be read, and in the second place, it took so long to decipher even one tablet that it looked as though our civilization would be dead, and forgotten too, before that Babylonian correspondence was figured out.

Babylonians did their "nail" writing by jabbing the triangular point of a stylus into small pieces of wet clay. Sometimes, when the letters were of particular importance, they baked the tablets, but usually they merely dried them in the sun.

After these tablets had been in the ground for a few thousand years, they began to get soft and squishy. When they were dug out, they were in danger of being mashed before the scholars could decipher them. Even when they were dried successfully, they

By
**R. DeWITT
MILLER**

were often covered over with mineral salts.

Then somebody thought of calling in a chemist. The chemist experimented with homemade tablets, and then came to the conclusion that it was possible to finish the Babylonians' job for them. In other words, he devised a method whereby the tablets could be removed from the excavation, dried in the sun, specially packed, and finally baked in a modern electric furnace.

Next, the chemist fiddled with acids, and finally found that certain acids would remove the incrustation of salt without injuring the tablets.

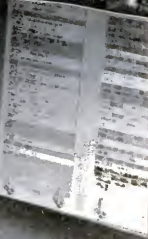
But there still remained the problem of the slowness of translation. Now one of the biggest difficulties in this work was the fact that the Babylonians used so many signs that no normal scholar could carry them all in his mind. That meant endless time spent thumbing through the pages of reference books.

Recently, when he was getting tired of looking up Babylonian signs, Dr. Carl S. Knopf, of the University of Southern California, had an idea. He suddenly realized that the problem wasn't one of archæology, but of business efficiency.

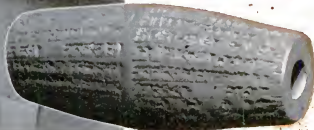
So he consulted a bookkeeper, and together they worked out a visual index system by which the meaning of any sign could be found almost instantly.

Thus a combination of chemistry, book-keeping, and scholarship has recently opened the door to the personal lives of people whose civilization lies deep beneath the desert sands.

On a tiny bit of clay a naive and baffled lover writes to his sweetheart:



A Babylonian letter in its forgeryproof envelope. To preserve tablets they dig up, archaeologists often bake them in an electric oven as at top. At the left, Dr. Carl S. Knopf removes crystals of salt with acid from a cylinder on which is inscribed the biography of a king





With a special bookkeeping system, Dr. Knopf instantly locates the meaning of any cuneiform character, thus speeding up his translation work

The round tablet was used by a beginner to practice a lesson in writing. Above, a signature seal

"To Bibeá: May the gods for my sake preserve your health. Tell me how you are. I went to Babylon but I did not see you. I was greatly disappointed. Write me the reason for your leaving, and let me be cheered. For my sake keep well always. Gimil."

But if Gimil's love letter gives the impression of having been written today, many Baby-

These tiny cylinders of stone or shell, about an inch high, were carved with scenes from daily life. Each person had his own scene. To sign a document, it was only necessary to roll the cylinder over the wet clay, thereby impressing the scene. As the figures were cut in reverse, this custom probably represents the world's first attempt at printing.

Among the endless pieces of Babylonian private correspondence, there is one which reads:

"To the king my lord, your servant Ashur-Mukin has ordered me to transport in boats the colossal stone bulls. The boats are not strong enough and are not ready. But if a present be kindly made to us, we will see what can be done about it."

It took 4,000 years and the help of modern science to bring that bit of graft to light.



Such spikelike clay seals as this were driven into walls of new buildings to preserve the story of a king's might

Cabinet Holds Electric Carillon

HOUSED in a cabinet no larger than a radio console, an electric bell system just developed produces the rich, full tones of huge carillon bells. Metal reeds, vibrated by keys on a piano-type keyboard, induce magnetic currents that are amplified and conducted to a loudspeaker. The unit illustrated plays a five-tone chime; another has the range of a twenty-six-bell carillon.

Keys on this electric unit play a five-tone chime for schools and other public places



New Thread-Cutting Screw Fastens as It Taps

RECENTLY placed on the market is a self-tapping screw which has not only a series of grooves cut into the side to remove the chips accumulating in the process of cutting a thread, but also a fully threaded, ungrooved section just under the head which is greater in diameter than the cutting portion of the shank. This new feature provides a friction contact to hold the screw securely in place after it has been driven.



Fully threaded sections near the heads fasten the screws into place

Portable Alarm Gives Warning When Door Is Opened

SET against the inside of a door, a portable electric burglar alarm sounds a buzzer and flashes on a light to mark the spot, when an intruder attempts to enter. Resembling a large electric lantern, the unit is set on the floor with its wire handle extending horizontally to touch the door. When the latter is opened, the alarm device is tipped over on its back, closing a switch contact as it strikes the floor, and turning on the loud buzzer and the light. Easily moved from place to place, the compact door guard is powered by a battery of dry cells, which will operate the buzzer and light continuously for a period of about six hours.

Set by a door, as below, the burglar alarm is upset by an intruder. A buzzer sounds and the light is turned on



At right, Murray Bolen gets a spoken autograph from Ann Sheridan, movie star. In a nearby automobile, below, Jean Jones is operating the sound apparatus to "can" their conversation



Movie Fans Collect Stars' Voices

A LIBRARY of phonograph records constitutes the unusual "autograph album" of two Hollywood enthusiasts, whose hobby is collecting the voices of movie actors and actresses. Not satisfied with mere signatures scrawled in a book, they have developed a technique of their own to obtain a more interesting souvenir. Leaving a theater after a "personal appearance," a film star is greeted by Murray Bolen, the interviewer of the team, and engaged in conversation before a microphone that he holds in his hand. A trailing wire leads to a car parked at the curb, where his fellow hobbyist, Jean Jones, manipulates sound apparatus that records the chat. After processing, the finished record is decorated for identification with a picture of the celebrity whose "spoken autograph" it holds. It can be played on any phonograph, and is good for about 100 reproductions. Photographs on this page show the pair engaged in their novel form of celebrity hunting, from the original interview to the finished product.



New Game Combines Polo and Lacrosse

FEATURES of both polo and lacrosse are combined in a novel game introduced in England not long ago and now gaining in popularity. Mounted on horseback, the players wield long-handled rackets which have oval, open-faced ends covered with a loose netting in which the ball may be scooped up from the ground, cradled as in lacrosse, and then thrown, to be caught by another player riding down the field toward the goal. The ball used is about the size of an indoor baseball, but is smooth instead of being ribbed. In the photograph at the right, two "polo-lacrosse" players are attempting to scoop up a grounded ball.



How a player scoops up the ball to make a pass in the new polo-lacrosse game



Rubber-Tired Dump Cart Is Handy Yard Accessory

EQUIPPED with an all-steel body and rubber-tired wheels, a sturdy new dump cart should prove a handy accessory for home owners and amateur gardeners. The cart,

whose load is released by removing an end gate, has a capacity of 300 pounds, and can be used for hauling leaves, soil, and sand. With its sides removed, it is handy for transporting large stones, stacks of long boards, or a ladder.

Ash Receiver "Stays Put"

A "BEAN-BAG" ash tray just introduced can be balanced on a smoker's knee or the arm of his chair. The metal tray is mounted in a fabric base partially filled with lead shot so that it balances by conforming to the surface on which it is placed.



You can balance this "bean-bag" tray on a chair arm

Soda Straws Help Teach Industrial Art



A student of industrial design building a complicated structure of soda straws. Toothpicks form the joints

SAFETY PINS, price tags, pen points, corks, matches, soda straws, and rubber bands serve as working materials in a New York school of industrial design. To learn how to give a pleasing appearance to anything from a vanity case to a locomotive, art students are given a single "basic" material—soda straws, for example. When they have thoroughly explored the possibilities of a single material in relation to designs, joints, stresses, and strains, they are given other materials to combine with it in their experiments. The method is declared more realistic and instructive than making paper sketches, and the negligible cost of the materials permits a wide variety of experiments.

Paper Lip Shields Protect Clothing

AFTER shopping for dresses, a woman complained of finding attractive ones indelibly stained with lipstick. So her husband, a professor in an eastern university, has invented paper "lip guards" for customers trying on garments in stores, and for home use as well, to protect make-up and clothing.



Held in the mouth, a shield protects dresses being put on over the head. Left, a dispenser and, lower left, a separate lip shield



Miss Neff assembling one of the novel seed necklaces that have brought her fame

Her Business Grew from Pumpkin Seeds

MAKING VEGETABLE JEWELRY
PROVES A PROFITABLE HOBBY



Artificial leaves, seeds, and wire produced these dainty "spinach" flowers



Holes drilled in the beans take the stringing thread

CARVING a jack-o'-lantern, last Halloween, led Miss Grace Neff, New York fiction writer, into the unique and profitable business of making jewelry from vegetable seeds. After she finished the jack-o'-lantern for a small boy, she dried the seeds and threaded them together to form a necklace. Friends admired it so much that she tried her hand at brooches and bracelets as well as necklaces and used lima beans, corn kernels, lentils, navy beans, kidney beans, and even spinach seeds in the work. When she discovered that, after a few weeks, her jewelry began to sprout, a chemist worked out a solution that would sterilize the seeds. Then she experimented with scores of lacquers and paints until she found just the pastel shades she wanted for tinting the ornaments. Started as a hobby, making seed jewelry has become a thriving business in less than a year.



Two seed necklaces and a bean bracelet



LUNACY LABORATORY
Russell H. Oakes in the basement workshop where he cooks up his laugh-provoking gadgets. A few are shown here

Goofy Inventions Are His Hobby

By **ROBERT E. MARTIN**

RUSSELL H. OAKES, a Waukesha, Wis., advertising man, is the Thomas A. Edison of goofy gadgets. Out of his basement workshop have come more than fifty screwball innovations. They have no practical value on earth. They will never see the inside of the Patent Office "Gazette." They have no standing as labor-saving devices. Yet, they are making their inventor famous!

Audiences throughout the middle west have roared with laughter as he demonstrated them. On the radio, he has explained his brainstorm to millions of listeners. Screwball inventing is his hobby. He has been en-

gaged in this unusual avocation for years.

One spring morning in 1935, a friend invited him to show a few of his laugh-getting mechanisms at a banquet being given in Milwaukee, Wis., for salesmen of a hydraulic-jack concern. On the night of the banquet, Oakes arose solemnly, dressed in a black Prince Albert coat and "gates-ajar" collar, and announced his latest contribution to science—the world's first hydraulic cigarette lighter. Then he unveiled a fantastic mechanism and poured water into a projecting funnel. The water sprayed over a sponge, increasing its weight so it opened a trapdoor, releasing a weighted rubber mouse on an in-



MOVIE CHATTER ELIMINATOR

The headphone device at right enables a moviegoer to "tune in" either on the show or on the conversation behind him



clined plane. The mouse landed on a platform and so raised an arm bearing a needle that pricked a balloon. The collapse of the gas bag permitted a weight to fall, thus revolving an emery wheel against the "firing element"—a common match.

Since demonstrating this hilarious "hydraulic lighter," Oakes has been in wide demand as an entertainer. He is introduced to his audiences as "Prof. Ratzin de Garrett." During the course of his programs, he demonstrates inventions that run all the way from a noiseless soup spoon to a church collection plate which flashes on a red light when only a nickel is dropped in it. His "dripless doughnut dunker" invariably brings howls of laughter from the crowd.

This device, he explains, was invented for the diner who likes to dunk but is afraid he will scald his thumb and forefinger or will drip coffee across a clean tablecloth. It consists of a mobile unit resting on three casters above which is mounted a long arm holding a doughnut. The arm swings the doughnut over the coffee, dunks it, lifts it, and—while a small drain pan swings into position beneath it—raises it to the mouth of the diner. As the professor explains it, you "dunker, raiser, and drainer" in a single operation.

A large share of Oakes' inventions have resulted from the experiences of his friends. Recently, a business acquaintance complained that he had lost three golf balls over the week-end. "What you need," Oakes told him, "is a self-finding ball." He proceeded to invent one. It is a five-inch rubber ball with a mechanism inside which, under a slight pressure, raises a collapsible red flag and blows



This unobtrusive air filter protects the wearer against the odor of cooking onions

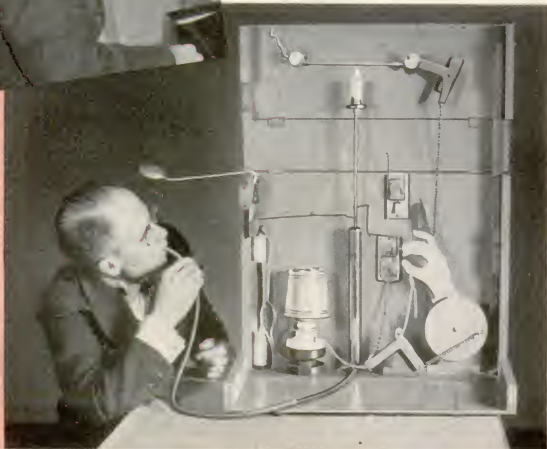


The fly shoeer above keeps wandering insects off a picnic sandwich



Eating peas with a knife is easy and safe if you use a streamline knife guard, demonstrated here by Oakes

The simple device at right puts out the light after you go to sleep. Snore exhaust moves the pumpplunger, starting the mechanism



a horn. Instead of indentations, the ball is equipped with knobs. They, the professor explains, are feelers which signal the inner mechanism when the ball rolls into the rough.

A good share of his innovations are related to what the professor calls "one of the great international sports"—eating. There is a spaghetti fork which combines the features of a fork and an eggbeater. There is a knife equipped with a streamline scoop to prevent peas from rolling off the blade. There is a fly shoeer which waves back and forth over a picnic sandwich. And, finally, there is a straw hat for use in eating grapefruit. It is equipped with a curtain attached by a roller to the brim. This curtain can be pulled down, protecting the face from squirting juice while providing windows for the eyes and an opening for the mouth.

The end of day finds Oakes ready to help insomnia victims with one of the goofiest of his burlesque inventions, a sheep counter. This slumber wooer consists of a mechanical sheep jumping over a fence while a meter automatically records the number of jumps.

Instead of counting the sheep, all the user has to do is to occasionally glance at the meter! Another aid to sleepers harnesses snore power to turn out the bedside light.

Crazy? Of course, the inventions are absurd. But they are bringing laughter to thousands of persons and they are bringing fame to the man whose hobby is devising them—"Prof. Ratzin de Garrett" Oakes.



"Prof. Ratzin de Garrett" displays his famous hydrolic cigarette lighter, which sometimes works



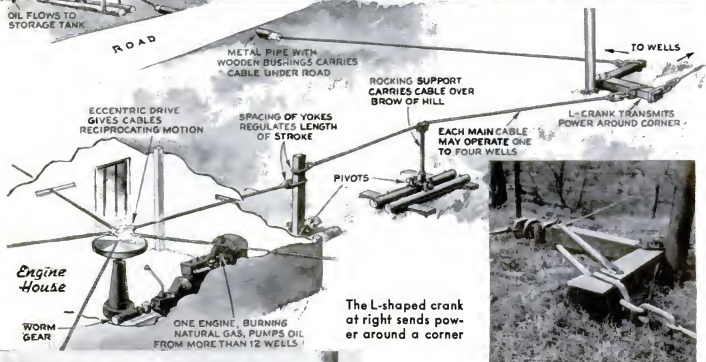
Insomnia victims hail the slumber wooer, in which a mechanical sheep jumps over a miniature fence while a counting device keeps the score. All you have to do is to glance at it from time to time

And below he shows his ingenious drip-less doughnut dunker



Pumping Oil by Remote Control

From this central engine house, cables radiate to drive scattered oil pumps. The drawing below shows the ingenious methods by which pull is transmitted



The L-shaped crank at right sends power around a corner



One of the wells, with the rocking-lever mechanism that transforms the cable pull into straight-line motion for the pump. The engine house is seen on the distant hill

THROUGH an ingenious system of levers and cables, a single gas engine may simultaneously pump oil from more than a dozen scattered wells in a West Virginia field. An eccentric drive imparts a reciprocating motion to cables extending from slots in the walls of the engine house. Follow one and you may find its power carried over the brow of a hill by a rocking lever; around a corner by an L-shaped timber crank; or under a road, through a pipe plugged with wooden bushings to reduce wear on the greased cable. At its end, pivoted arms transform its pull into a "straight-line motion" that operates the plunger of the pump. Primitive but effective, the system saves the cost of installing separate engines.



Flying Tankers Refuel Ocean Planes

TO MAKE heavier pay loads possible, British Imperial Airways flying boats are fueled in mid-air after they have taken off on transatlantic flights. Making a safe and easy

take-off with fuel tanks only partially filled, the transports take on an additional 1,000 gallons of gasoline from converted bombing planes that serve as flying fuel tankers.



Jointed earpieces make the bows adjustable for size

Adjustable Sun Glasses Will Fit Any Wearer

GLAREPROOF sun glasses that can be adjusted to fit anyone who wears them, regardless of the size of his head, have recently been introduced. Hinged ear pieces on the ends of the spectacle bows make it possible to extend or shorten them to the right length. A friction joint makes the hinged earpieces stay put when once adjusted.

New Garage Jack Has a Spotlight

BUILT into a new hydraulic automobile jack designed for garage use, a light controlled by a button on the jack handle throws a strong illuminating beam to make it easy to place the jack under a car at night or in dimly lighted quarters.



Pushing a button on the handle of the jack switches on the built-in spotlight

"SPIRIT

Latest Trick

QUICK to adapt their technique to modern styles, fake spiritualists have now introduced "psychic television" to cajole money from those who have suffered bereavement.

Promised a view of a loved one who has passed away, the medium's intended victim is seated before a window in a small, ornate cabinet resembling a television receiver. He writes the name of the dead person upon a blank sheet of paper, which is handed to him on a frame and then placed in the machine. The room darkens. A humming sound is heard from the apparatus. Twinkling lights appear and disappear. Mysterious rapping sounds, and the crackling of an electric arc, heighten the drama. The screen begins to glow. A face appears upon it—first dimly, then clear and sharp. It is the image of the lost relative.

Pictures on these pages show how the deception is performed. Gaining entrance to a prospect's home—on such a pretext as testing the telephone—one of the medium's agents contrives

How fake mediums work their new "spirit television" trick. Posing as a telephone inspector or other service worker, an agent gains admittance to an intended victim's home, locates a portrait of the dead relative, and rephotographs it

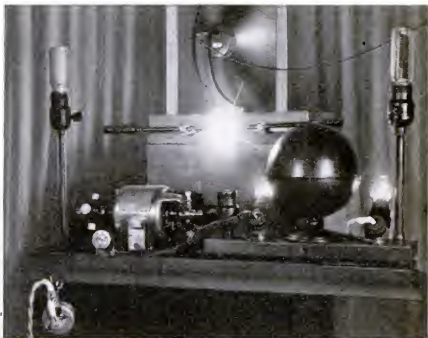


TELEVISION"

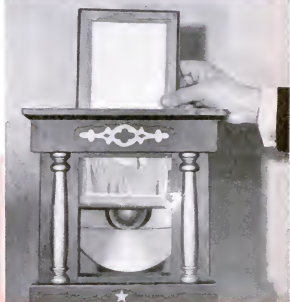
of Fake Spiritualists

to find and rephotograph a portrait of the member of the family who has died. A trick frame makes it easy for the medium to insert an enlargement in the "television" machine along with the blank paper, which serves as a screen. Illuminated from the rear, the photograph is drawn forward along a track toward the screen by a concealed thread, so that it gradually becomes more clearly defined. The rest of the apparatus—lights, arc, and humming motor—is simply for "atmosphere." Glib-tongued showmanship, aided by what the medium and his agent have been able to learn about the deceased through secret investigation, help make the fraud convincing enough to yield rich returns.

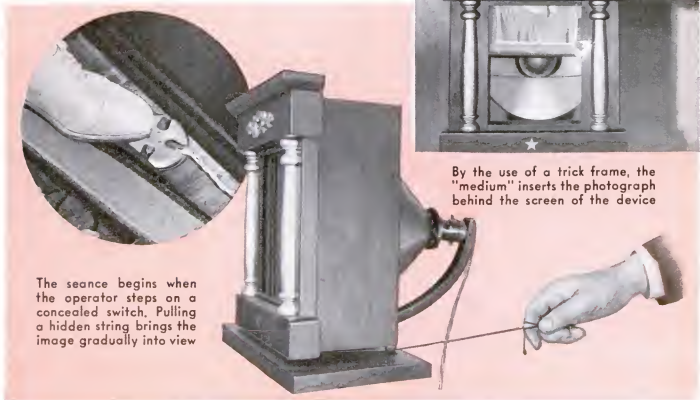
This series of photographs, made with the cooperation of Sam Grossman, of the Society of American Magicians, is designed to protect the public by exposing the methods used in this heartless exploitation of grief.



Back view of the scientific-looking "television" in which the "spirit face" appears. Most of the trappings are for atmosphere only



By the use of a trick frame, the "medium" inserts the photograph behind the screen of the device



The seance begins when the operator steps on a concealed switch. Pulling a hidden string brings the image gradually into view

Coin-in-Slot Mail Box Stamps Letters



YOU don't have to wait in line to buy postage stamps, when you use a coin-operated "stampless" mail box of new design. To operate it, you first insert enough coins to cover the total postage for your batch of mail. Second, you twirl a dial to the amount that the first post card or letter requires—any figure from one to twenty-two cents. Third, you push the missive into a slot where an electric mechanism automatically stamps it, cancels it, postmarks it, and drops it into a collection box below. For each additional piece of mail, you simply repeat the second and third steps. Instead of using adhesive stamps, the "automatic post office" imprints a symbol showing that the postage has been paid, like postage meters used by business firms. Usable at any hour of the day or night, the mail automat are expected to be widely installed in stores, hotels, and stations.

Rubber Model-Railway Ties

TO SILENCE the rumble of toy electric trains, shock-absorbing rubber ties are now available for use with standard track of popular sizes. The ties are attached simply by slipping them beneath the rails, as shown in the photograph below; no tools, nails, or screws are required. Molded with a corrugated base, the rubber "feet" also prevent the track from creeping. With other noise eliminated, the comparatively faint click of rail joints is heard plainly, adding realism.



Ties are attached by slipping them beneath the rails

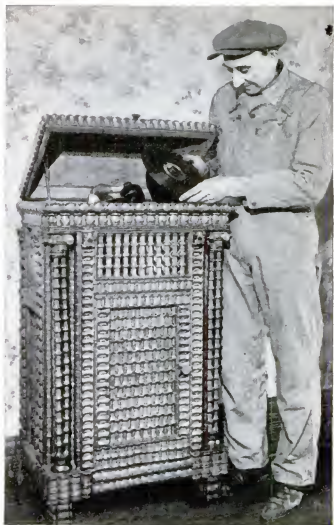


Portable Electric Guitar

CARRIED like a suitcase, the compact cabinet above not only serves as a case for an electric guitar but also houses the amplifying equipment and loudspeaker. With the self-contained unit, a traveling player is spared the burden of transporting both his instrument and a separate amplifier.

Spools and Clothesline Turned into Furniture

MAKING articles of furniture out of wooden spools and lengths of cord and clothesline is the odd hobby of John Becker, of Chicago, Ill. In the photograph at the right, Becker is pictured proudly examining one of his creations, a radio-phonograph cabinet that took him ten months of spare-time labor to complete, and which incorporates 1,492 spools and eighty feet of clothesline.



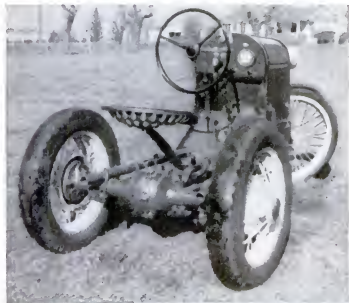
John Becker and a radio-phonograph cabinet he made from 1,492 spools and eighty feet of clothesline

Improved Thumb Splint Uses Spring Tension

A METAL brace which is strapped to the wrist of a patient was introduced to hospital officials recently as an improved type of splint to hold an injured or broken thumb in an im-



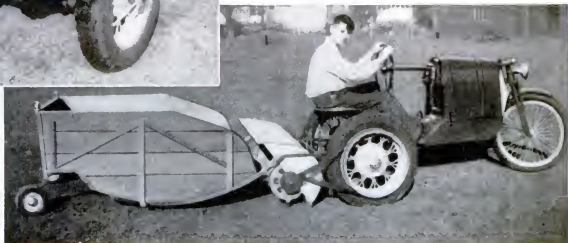
movable position until it heals. As pictured at the left, the thumb is supported in an upright metal rest, which has an extension supporting a tiny spring that terminates in a clip. The latter is cemented to the thumb nail, so that the spring maintains the thumb in a rigid position.



Three-Wheel Tractor Built by High-School Student

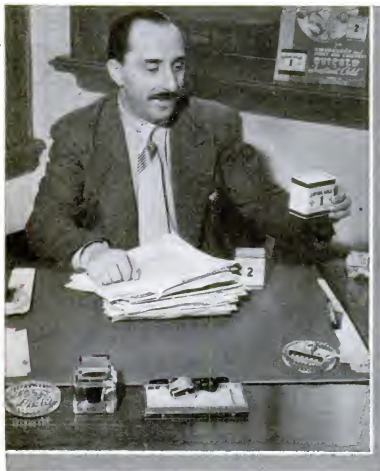
RUNNING forty to fifty miles on a gallon of gasoline, a homemade three-wheel tractor constructed by Thomas Wightman, Jr., Elk Grove, Calif., high-school student, was built from old automobile and motor-cycle parts. Designed to pull a lawn sweeper, the tractor boasts six speeds forward and two reverse, with an automatic liquid clutch.

This homemade tractor has a top speed of twenty-five miles an hour. At right, the builder, Thomas Wightman, Jr., uses it to run a lawn sweeper



Canned "COLD"

HOME CHEMIST DISCOVERS A POWDER



Richard M. Sherton, whose chemistry hobby led him to discovery of an amazing new refrigerant

By SCHUYLER VAN DUYN

LIKE baked beans, soup, and corned beef, "cold" is now being sold in cans. Through the amazing discovery of an amateur chemist, you can go to your pantry shelf, lift down two cans, mix small amounts of the powders they contain, add water, and obtain chemical coldness that can be used to chill bottles of drinks, fill ice bags for medical purposes, and do a score of other household chores. Ice no longer is a picnic problem if you have "canned cold" stored away in your food basket.

Based on the chemical fact that when some substances react they absorb heat instead of giving it off as is usually the case, the new canned cold is capable of lowering its temperature to fifteen or twenty degrees below the freezing point of water. Liquids and foods to be cooled are simply placed in closed con-

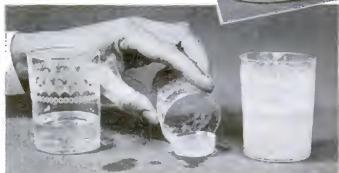
tainers and immersed in the frigid solution made by mixing two almost colorless powders and adding a small amount of water. In its uses, it differs from ice only in that it does not come in contact with what it is meant to cool, and thus does not dilute or weaken it.

Almost as amazing as the new chemical cold itself, however, is the manner in which it was discovered. When Richard M. Sherton, the amateur chemist of New York City who perfected it, tells about it, he admits that he started simply "by mixing things together," and then he tops it off by saying that it was really a pet Brazilian monkey hopping around in his small home laboratory that finally turned the trick that brought success.

Ten years ago, Sherton, then living in Brazil, took up amateur chemistry as



Proof of the cooling power of "canned cold." Above, the right-hand glass contains the chemicals. Water is added, and a small glass containing water is placed in it as at right



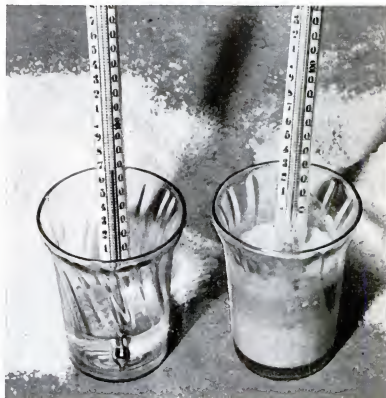
After a few minutes, the small glass is removed. The water it contained has frozen solid. While intended for chilling things, the powders can freeze ice cream

for Your Kitchen Shelf

THAT COOLS BETTER THAN NATURAL ICE

a hobby. In his importing-exporting business, he saw the need for a powdered refrigerant that would always be available for instant use. He soon discovered that there were hundreds of chemicals that absorbed heat during reaction, but they all lacked one or more of the three qualities essential for general use—cheapness, harmlessness, and chemical stability. So for nearly eight years, between frequent business trips, Sherton worked in his Rio de Janeiro home laboratory blending, mixing, analyzing, watching, testing, and finally throwing away as useless more than 250 different chemicals. In time, he solved two of his major problems. He got satisfactory substances that were nonpoisonous and cheap. But nothing he added kept them from spoiling when exposed to air.

It was near dawn one morning when



Water at sixty-eight degrees is added to the chemicals. In a minute, the thermometer has dropped fifty-five degrees

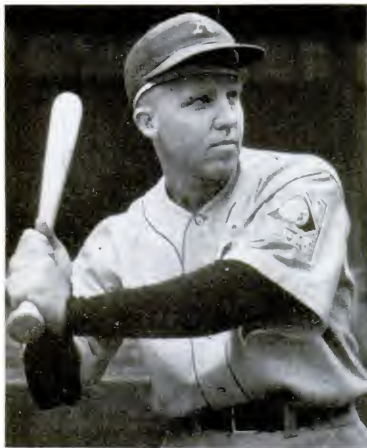


Here the refrigerant has been put in an inner tube attached to a shaker top. Fruit juice poured into the shaker is cooled quickly and without dilution

he left his workshop and went to bed, discouraged by continued failure. He didn't even bother to throw away the product of his latest experiment, a dishful of mixed powders that were gradually turning into a useless paste as they absorbed water from the air.

Four hours later, he was back at his bench, and on the point of throwing out the dish of chemicals when he noticed that its contents were as dry as a bone. Excited, he added some water. The solution turned icy cold. A glance at a row of shelves above the bench showed where a thin trickle of powder had cascaded from the uppermost shelf to the plate on the bench. Upset on the shelf, with its stopper off, was a bottle that had held the spilled powder. Beside the bottle, which it had obviously knocked over, was a tiny Brazilian monkey Sherton kept as a pet, sound asleep. The powdery chemical, until then untried, had perfected his formula.

Sherton put his discovery through many months of tests. He sent samples to friends in many parts of the world, to try the effect of different climates. As a result, he perfected his formula and recently put his "cold powders" on the market.



Lamar Newsome comes up to bat in his skull-protecting headgear. Seen at right, it is worn under a cap

Baseball Player Wears Protective Helmet

LAMAR NEWSOME, infielder of the Philadelphia American League baseball club, who was out of the line-up most of last year because of an injury received when he was struck on the head by a ball, is shown at the left wearing a protective helmet

under his regulation cap. Made of felt, crisscrossed on the top with reinforcing strips of tape, the head protector is similar to those used in Australia by steeplechase jockeys to protect their skulls if they take a spill in a jump. The skull cushion is strong enough to absorb the shock of a thrown or batted ball, but light enough to be worn without discomfort. It is believed the idea may be adopted widely.



Buoy Marks Spot When Seaplane Crashes

REFLECTING light from the ninety-one separate facets that make up its surface, a chrome-plated ball invented by Leon E. Douglass, of San Francisco, Calif., is designed to serve as a marker buoy for seaplanes forced down on the ocean or other large bodies of water. Kept in a special container in the plane, the ball will float on the surface of the water after a forced ocean landing, its diamondlike surface reflecting sunlight or the rays of searchlights, to guide rescuers.

Napkin Comes with Popcorn



A NAPKIN is provided with each box of buttered popcorn, by an invention of Aston L. Moore, of South Bend, Ind. The popcorn box has a slot through which the napkin may be extracted from its storage space between the inside of the box and the oiled paper containing the popcorn, where it is kept free from stain.



Reflecting marker buoy with its canvas sea anchor



Live-Steam Shampoo Cleans Navy Planes

A SHAMPOO with live steam is the method adopted at the U. S. Naval Air Reserve Base at Floyd Bennett Field, Long Island, N.Y., to keep Navy planes spick-and-span. Mixing soapsuds and water, a special portable ap-

paratus creates live steam, which is sprayed under pressure through a nozzle onto the plane. All parts of the ship are thoroughly cleaned in this manner, the steam being harmless even to exposed engine parts.

Portable Case Holds Typist's Aids

TYPEWRITER paper, envelopes in several sizes, pencils, erasers, typewriter ribbons, carbon paper, and other typing accessories are neatly stored in convenient form in a compact, portable container designed as a companion piece to a portable typewriter. Paper is kept in compartments built into the top, while a drawer holds smaller items.



Carried along with a portable typewriter, this handy case accommodates paper, envelopes, pencils, and other accessories. It is seen opened at the left

Perfume Kit Lets You Mix Your Own

Mixing together ingredients of the kit to get an "individual" perfume



NEW and unusual odors may be created to suit individual fancy, with a perfume-blending kit just placed on the market. Offering a wide variety of ingredients from which to choose, it also enables the user to compound a number of standard perfumes. The outfit includes perfume spirits, essential oils, fixative, and coloring matter, together with all necessary apparatus for mixing, and complete instructions. Labels designate the perfume-blending materials both by name and by letter to aid an experimenter in making up a list of suggested formulas. The kit is shown in the picture at the left.

Thread Trimmer Fits Spool

ATTACHED in a jiffy to the end of a spool, a tiny metal accessory serves to cut, point, and hold the thread. When the spool is empty, the cutter may be pried off with scissors or a screw driver and used again on another one. The new sewing aids are sold in boxes containing a liberal supply, and a small rivet-shaped tool for applying them, as shown at right, with a gentle tap from a hammer or any convenient substitute.



Homemade Lawn Roller Smooths Slopes

USING parts salvaged from old cars and trucks, H. W. Taylor of Danbury, Conn., has built the unusual lawn-rolling machine illustrated in action below. Employed on lawns of large estates, the one-ton apparatus can

cover an acre an hour, and is said to eliminate two thirds of the labor cost. An ingenious power winch mounted on one side of the machine makes short work of maneuvering a heavy roller up and down steeply sloping ground, which would be difficult or impossible to roll by hand.



How the machine rolls a terrace with its auxiliary hand roller on a winch. On the level, the machine itself does the rolling

Quitters Can't Win

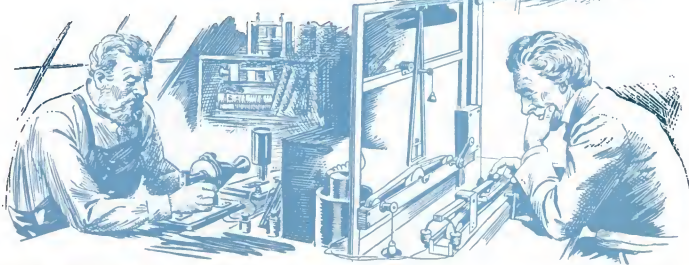
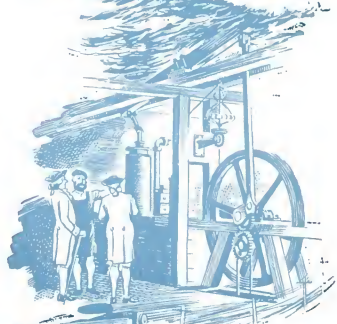
By BERTON BRALEY

Worn out? Tuckered? Weary?
Sick of heart and soul?
So was Admiral Peary
But—he found the pole;
Bell grew fagged and tired,
So did Watt and Morse;
Jaded, uninspired,
Still they kept their course.

Great Columbus sometimes
Found his spirit staled,
Knew his doubtful, glum times,
Yet he sailed and sailed.
Shakespeare, Milton, Dante,
Wearied, haggard, wrote
When their strength was scanty
Poems that we quote.

When the power in you
Is no longer fresh;
When, if you continue,
Mind must conquer flesh;
When your spirit's breaking,
Can you struggle on,
Trudge the last mile aching,
Panting, spent, "all gone"?

All that ever mattered,
All the true success,
Is the fruit of battered,
Painful weariness.
Bridge and road and steeple,
Light amid the murk
—Made by tired people
Sticking to their work!



Queen Jobs



IF YOU have any aerial chores to be done, Archie Baxter will do them. Baxter, a former New York taxicab driver, has become famous as the handy man of the air. His light planes at Floyd Bennett Field, New York, have been hired for everything from delivering newspapers and advertising lunch rooms to taking up "bingo" prize winners and hunting stolen motor boats.

Three years ago, Baxter started his unique sky-chore service. Since then, his winged taxis and flying delivery wagons have covered tens of thousands of miles. They have been used by salesmen to beat rivals to prospects in near-by cities; by politicians to carry electioneering slogans over the houses of voters; by amateur photographers to obtain aerial snapshots of the Statue of Liberty and the Empire State Building.

One of the first odd jobs Baxter got when he started his service came from a young man whose best girl was sailing for Europe. He wanted to fly out over New York Bay and wave good-bye as the vessel put out to sea. Nowadays, requests of this kind are commonplace. Baxter often makes several such flights in a week. The charge is from three to five dollars, depending on the length of



At top, Archie Baxter lets a fare take over the controls on an aerial "joy ride"

Above, a salesman is planning a flying trip to reach prospects ahead of his earthbound rivals

In his tiny office at Floyd Bennett Field, Baxter interviews a youth who wants to take flying lessons



of the Flying Taxis

FROM CHASING MODEL AIRPLANES
TO PILOTING THE CAMERA FANS,
IT'S ALL IN THE DAY'S WORK FOR
THIS HANDY MAN OF THE SKYWAYS

time in the air. Sometimes, the person renting the plane asks to have some message, like "Bon Voyage Mrs. Jones," chalked on the under side of the wing.

Not long ago, a bathing party near Floyd Bennett Field saw one of its members sink beneath the water and disappear. Relatives hired Baxter to search for the body. Flying at reduced speed, he cruised back and forth until he located the drowned man in the water below. He circled over the spot

By radio, he instructs a student on a solo flight



When a stranded plane needs a propeller or other spare part, a hurry call to Baxter brings it in a jiffy



Camera fans hire aerial taxis to try snapping pictures from high altitudes

... and news photographers, for getting shots like the Navy blimp at right

Delivering papers to vacation resorts is a summer chore. The bundles are dropped to carriers



until a boat put out from shore and recovered the body.

Camera clubs often come out to the field on bright Sunday mornings to try their hand at snapping pictures from the air. Baxter offers a prize for the best aerial shot made from one of his "jack-of-all-trades" monoplanes. The three things most amateurs want to photograph, he has found, are the Statue of Liberty, the Empire State Building, and the New York World's Fair.

A couple of summers ago a circulation battle between rival New York newspapers brought a harvest for Baxter. Almost daily, he flew extra editions out over Long Island, dropping bundles of papers in vacant lots where newsboys were waiting. Carrying papers and passengers to summer camps and rushing spare parts to grounded airplanes are other sources of revenue.

When a New York theater recently offered free flying lessons as a prize in a contest, it

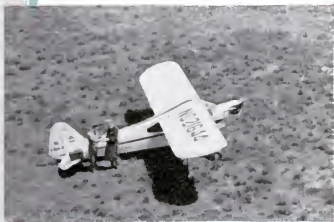
was Baxter who taught the winner to fly. A midget radio receiving set installed in one of his training planes enables him to keep in touch with students making their first solos. All told, he has taken up more than 200 passengers who had never touched the controls of a plane before and, after a few minutes instructions, has let them handle the ship in the air. Such "fly-it-yourself" thrill rides cost only two dollars. For cross-country trips, Baxter charges from twelve to fifteen cents a mile.

Patrolling oyster beds to spot poachers, speeding a new propeller to a stranded motorboat, circling over Sheepshead Bay to spot schools of fish for anglers—these are some of the other unusual chores of Baxter's air-

taxi fleet. When some big news event breaks within a hundred miles of New York, he is likely to get a call to fly a reporter, photographer, or radio commentator to the spot. During motor-boat races and similar sporting events, he often soars above the contestants to give sports writers a first-hand view of the struggle.

"Riding herd" on a flock of gas-driven model airplanes is another of Baxter's aerial jobs. Whenever a gas-model competition is held in the vicinity, he is hired to stand by, ready to follow one of the little ships if it heads away on a cross-country jaunt. Recently, he trailed a six-foot monoplane for more than five miles. With its little gas tank empty, it finally landed in a marsh.

Out of the long list of curious activities in which Baxter's planes have been engaged, the queerest of all is probably a job that came in last winter. A foot of snow had fallen on Floyd Bennett Field and three of his ships were hired to pull sleds in a race across the airport.



Commuters call the flying taxi to take them to and from their summer homes. The tiny planes can land almost anywhere



Baxter is in great demand at model-airplane meets to trail wandering entries. Here he is spotting a model hung in a tree

Aerial advertising pays well. Masking tape, applied as seen at the right, spells out ads for merchants and business men





Concentric circles show how to arrange a well-rounded coiffure

Hairdressing "Meter" Eliminates Guesswork

A DEVICE recently invented by a well-known New York beauty expert is said to enable hairdressers to eliminate guesswork from the problem of designing the most flattering hair style for their women customers. As pictured at the left, the hairdresser places his customer in front of the unit, which consists of a series of evenly spaced, concentric wire circles. He then notes where the facial contours extend beyond a given circle, and arranges the coiffure to form a perfectly balanced circular effect for the entire outline of the head and face.

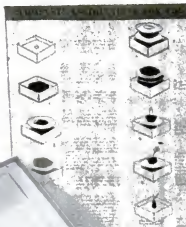
Artificial Flowers Made with New Kit

MORE than forty different kinds of artificial flowers can easily be made with a novel flower kit just placed on the market. When petals made of a special material are placed over a small hole in a cardboard box, a wooden plunger is used to force their centers downward

to form a stem, which is wrapped with green tape and wired into permanent shape. Cardboard rings are employed to keep various layers of petals apart while forming an artificial bloom. Complete instructions are furnished with the kit, which is pictured below.



A wooden plunger is used to force the petals partly through a hole to form a stem, which then is bound with wire and colored tape to make a finished flower



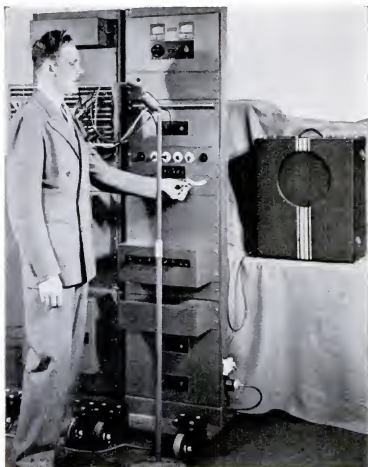
The realistic bunch of roses above was made with the kit. At right are the instructions and materials for making more than forty different kinds of flowers



Gongs Pace Runners in Training System

GONGS mounted on posts spaced around a running track, and set off by a new control apparatus, form an automatic pacer for track athletes. For a mile run, for example, the gongs might be spaced at quarter-mile dis-

tances, and the master control set to ring them at consecutive intervals of sixty-three seconds. If the gong sounded as a runner reached each post, he would know he was running at the required pace for a 4:12 mile.



He's singing a duet. This speech analyzer raises or lowers the pitch of words spoken into it, and does other tricks

Speech Analyzer Turns a Solo into a Duet

ALTHOUGH primarily intended to break down and analyze human speech for the benefit of research in telephone-communication problems, a novel electrical instrument developed by scientists at the Bell Telephone Laboratories in New York City performs a number of amazing tricks. In a recent demonstration, the intricate electrical apparatus raised or lowered the pitch of words spoken into a microphone, reproduced with a rising inflection a sentence a speaker had said with a falling inflection, changed the character of a young man's voice into the quavering tones of a man of ninety, and made a song sung by one man come out of a loudspeaker as a duet. Basically, it was explained, the apparatus breaks down the human voice into the two primary types of sound that constitute its raw materials, the first a hiss and the second a buzz. But the sound which ultimately emerges from the loudspeaker is not that which was spoken into the microphone, but is actually reconstructed from an artificially created hiss and buzz controlled by the speaker's voice.

How I Mapped Cuba

Aerial Photography with
Postage-Stamp Pictures
Charts Hundreds of Miles
of Tropical Coast Line

By
LOUIS HAMBURG



Stinson cabin monoplane used in mapping Cuba from the air. At top, Hamburg is aiming his miniature camera from the fuselage

WITH pictures hardly larger than postage stamps, I have been air-mapping the island of Cuba. Through the use of a miniature camera instead of an orthodox large-size outfit, the expense of the work has been cut to

Fitting the enlarged photographs together. Mounted thus, they are rephotographed and enlarged again to form the final map

one tenth the cost under ordinary methods.

How I operate my tiny camera in the air and how I enlarge and match the pictures from the diminutive negatives, can best be explained by following through one of my latest jobs. This was air-mapping virtually the whole northern coast of Cuba, from a point west of Havana to Baracoa, near the eastern tip of the island.

We take off at half past six on a cloudless morning in a Stinson cabin monoplane. At 5,000 feet, we level off and work begins. With the plane traveling eighty miles an hour, I snap pictures at regular intervals. Extra-large rolls of film in my Leica permit me to take forty-five photographs without reloading. Each time, when I come to the last exposure, I signal the pilot and he circles while I load in fresh film. Then we set off again.



with a Miniature Camera

I am on my twelfth roll by the time the job is done.

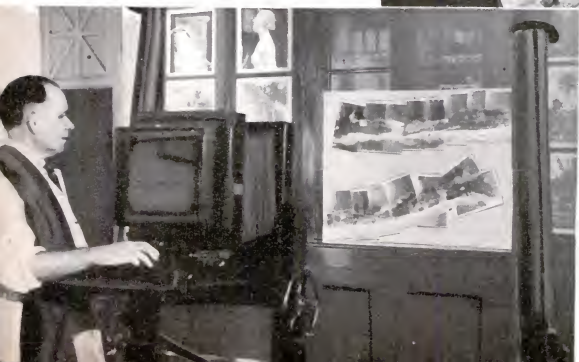
Because the wide-angle lens of my miniature camera takes in a greater area than a large-size aerial outfit, I am able to record as much territory at 5,000 feet as I could with a big camera at twice that altitude. Most of my shots are made with the camera set for 1/250 of a second at F/6.3. To cut through ground haze and increase the clearness of my pictures, I have a special filter slipped over the lens. And to reduce graininess in the negatives, I use fine-grain film and develop the rolls with a fine-grain formula.

In the darkroom, after the films have been fixed, washed, and dried, I start the delicate work of enlarging and assembling the map. All pictures have to be matched exactly for relative size and color. Sometimes, during the flight, the plane drops fifty or 100 feet or shoots aloft suddenly on a rising current. In enlarging the pictures, it is necessary to compensate for differences in altitude.

After all the enlarging has been completed, the pictures are carefully pasted together and photographed, in sections, on eight by ten-inch negatives. From these negatives, twenty by forty-inch enlargements are produced. These, in turn, are pasted together to provide the final large-size aerial map recording all features on the ground in the exact scale of one foot to 10,000 feet.



Two aerial views of Havana. In upper one the \$18,000,000 Capitol is seen. Lower picture shows harbor



Mounted enlargements about to be rephotographed with a copying camera on eight-by-ten film



Handle on Doughnut Is Boon to Dunkers

MAJOR hazards involved in the popular indoor sport of dunking doughnuts in hot coffee are said to be greatly reduced by the invention of a new type of "sinker" with a baked-in handle that should prove a boon to all dunking enthusiasts. Triangular in shape, the improved doughnut is fried around a wooden handle, making it far easier to maneuver in and out of a steaming draught of Java.

Movie Camera in Police Car Puts Evidence on Film

MOUNTED on the dashboard of his patrol car, with its lens pointing forward through the windshield, a motion-picture camera belonging to Officer R. H. Galbraith of the California Highway Patrol takes photographs of the automobiles he trails along the highways, making a permanent film record of any traffic violations for possible later use in court.



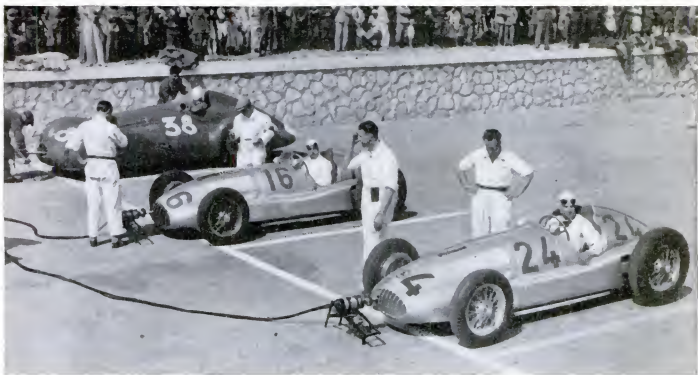
There's no arguing with the testimony of this movie camera



An engineering student puts finishing touches on a laboratory oven drier

Students Build Equipment for Engineering Lab

UNDERGRADUATES specializing in chemical engineering at the University of New Hampshire, in Durham, are building their own scientific laboratory equipment as part of their regular training. Four instruments have already been completed, a twenty-foot tunnel drier and a metal oven drier for use in testing the drying rates of various materials, a fluid-flow apparatus, and a heat exchanger to determine the rate of heat transfer when steam condenses.



Portable Motors Crank Racing Cars

INSTEAD of being pushed—the usual method of getting their motors started—racing cars entered in a fourteen-mile road race in Tripoli, Libya, had their engines started by means of electric cranks. Mounted on portable metal stands set up in front of each car, specially geared electric motors powered by means of

cables leading off the track to a power-supply source were attached directly to the engine crankshafts, as shown in the photograph reproduced above. The method was found to save considerable time over the older system of getting the delicately adjusted and often hard-starting cars under way.

Novel Frown-Wrinkle Preventives

SHAPED like a pair of wings, adhesive tabs just placed on the market as a new beauty aid are designed to prevent the formation of facial wrinkles and lines. Pasted on the forehead and around the eyes when doing any close work that tends to make a person squint, the tabs hold the skin smooth and prevent the creation of tiny furrows in the face, according to the manufacturer. The frown-preventing wings may also be used as a beauty aid while sleeping, being applied to the face just before going to bed.

Discouraging frowns, the winglike adhesive tabs prevent tiny lines from forming on the user's face



Easy-To-Clean Brush Perfumes User's Hair

BRISTLES in a sanitary hair-brush now available are set into a perforated aluminum base instead of the conventional wood. A handy backing slides off to facilitate washing, and a perfume-saturated pad can be inclosed in the backing to scent a person's hair at the same time that it is brushed.

Polish Army Trains Dogs To String Phone Lines

MODERN warfare may be becoming more and more mechanized, with tanks replacing cavalry and trucks doing the work of mules, but Polish Army authorities are now busily training corps of dogs for military duty. The war dogs are taught not only to carry messages and emergency supplies of food and ammunition, but also to haul reels of wire for stringing field-telephone lines.



How Polish soldiers put student dogs through their paces. Oval, a war dog stringing a field-telephone line



Not a roadside hot-dog stand, but a real plane, parked to save space

Planes Are Parked Ostrich Fashion To Conserve Space

LIKE ostriches hiding their heads in the sand, U.S. Army airplanes based at Mitchel Field, Long Island, N. Y., conserve hangar space by being parked with their motors and wings inside the hangar and their fuselages and tail surfaces outside, as shown at left. Holes cut in the edges of the hangar doors allow them to close around a plane's fuselage, leaving those sections outside which are less likely to be damaged by wind or rain.

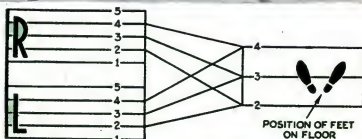
Dance Steps Written Like Music

JUST as musicians read the notes of a new song, tap and specialty dancers can read the steps of a new routine, when printed according to a system of writing dance steps in sheet-music form, worked out by James J. Petsch, of Hollywood, Calif. Two staves are employed, the top one for the right foot and the bottom one for the left. The steps are shown by special notes indicating the foundation steps such as stamp, hop, and jump, while time and measures are shown as in regular musical notation. The entire dance is divided into equal parts by vertical bars, and the bars match those in the musical accompaniment. Time beats—measured beats of equal duration, as in music—are marked above the right-foot staff, while the order in which each step is to be made is indi-

cated below the left-foot staff. Reading both staves simultaneously, as base and treble staves are read in music, the dancer can easily work out the entire dance by himself or with a partner.



Modern dance steps like this can be studied and practiced with "music" in which symbols represent steps. James J. Petsch, inventor of the system, displays a sample "dance score" below



One staff shows position of right foot, the other of left



Nat Fleischer compares a bulky pocket watch once owned by John L. Sullivan with a tiny modern timepiece he is adding to his collection, seen at right

Famous Fighters' Watches Form Unique Collection



ADD to the curious objects that people collect, the timepieces picked up by Nat Fleischer, of New York City. For years he has been collecting watches that belonged to famous sportsmen, especially prominent prize fighters. Timepieces owned by practically every heavyweight boxing champion between 1837 and 1939 have found their way into

Fleischer's odd collection, including those of John L. Sullivan, James J. Corbett, and Jack Dempsey. Dempsey's watch is the heaviest in the entire collection, and once belonged to another world champion, Bob Fitzsimmons. The Sullivan timepiece indicates the date and the lunar periods as well as the time.

Electric Vulcanizing Iron Can Be Used at Home

FOOD covers, salad bags, aprons, and other home accessories can easily be made from sheets of a new rubber composition material by using an electric vulcanizing iron now available. A small wheel with a corrugated rim, at one end of the iron, is heated electrically and then rolled across two edges of the material to vulcanize them together.



This electric tool vulcanizes composition rubber

This Windshield Wiper Washes It, Too



Turning a dashboard switch sends a stream of water across the windshield

WINDSHIELDS are automatically washed and scrubbed with clean water by a new automobile accessory available on a popular make of car. Turning a dashboard switch sends a stream of water from a small reservoir tank across the windshield glass, and the standard wiper blade completes the cleaning operation.

Scrubbing a Sky Giant's Back

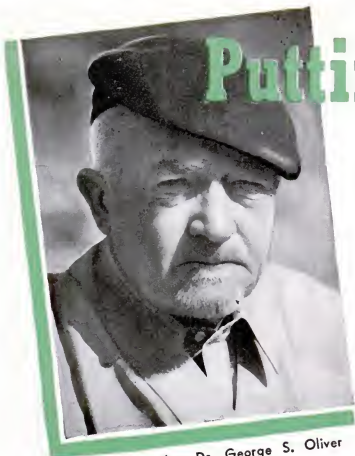


To put a high polish on the fuselage of the mammoth plane, this novel scrubbing method is employed

SCRUBBING the back of a huge sky giant is the odd task assigned to the two airport workers pictured in the photograph above. Using a long strip of soft cloth, they pull it back and forth over the surface of the mam-

moth transport to polish its metal fuselage to a gleaming finish in preparation for a flight. The plane shown is the recently completed Douglas DC-4 transport, the largest land airliner ever constructed.

Putting Earthworms to



Worm breeder—Dr. George S. Oliver

THE Burbank of the Earthworms is Dr. George Sheffield Oliver, of Los Angeles, Calif. He is engaged in the odd and important work of developing new types of earth borers for the improvement of American farms. As cattle breeders crossbreed live stock, Dr. Oliver hybridizes worms to obtain new types adapted to specific tasks. Crawlers developed at his unique "earthworm laboratory" are being planted in orchards and fields; they are feeding game birds at preserves; and they are boosting the profits on chicken ranches in various parts of the West.

Recently, for example, he crossed a large English brandling with a small California orchard worm to produce a creature which he believes is ideally suited for planting in farm soil to increase crop yields. Another of his underworld workers is a ten-inch "meat worm" evolved for feeding frogs, chickens, game birds, and fish at ranches and preserves. Still a third crossbreed is a chubby little worm, thick and fat, whose total weight and bulk runs about thirty percent pure medicinal oil. If anyone has a new use for earthworms, Dr. Oliver will "make a worm" to fit the specific job!

More than 1,000 species of earthworms are known to science. All of these lowly creatures obtain food by



The tree at the right grew in soil planted with earthworms

**Don't Scorn
the Humble Earthworm!
This California Expert
Says That Worms Are the
Farmer's Best Friends
—and He Has Proved
It by Results!**

Work on the Farm

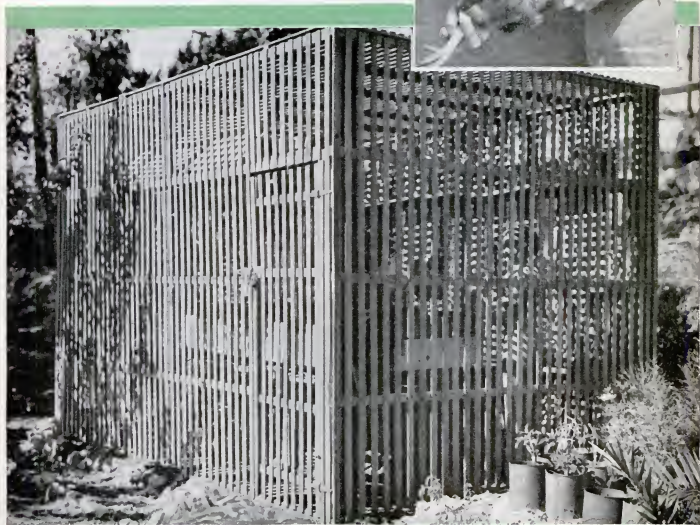
By
JOHN EDWIN
HOGG



Low-cost feed for intensive-range poultry raising. It consists of sprouted grain, earthworms, and the capsules of earthworm eggs



This picture shows the great size of eggs laid by seven-months-old Rhode Island red pullets fed on the earthworm diet



A simple, low-cost, twenty-five-bird poultry house set up by Dr. Oliver to demonstrate his perpetual-motion system of intensive-range feeding. The husky bird seen above is a sample of the results obtained

Selecting and packing breeding worms for shipment. Packed in damp peat moss in one-quart tins, they can be shipped anywhere by express or parcel post for use in enriching farm land



eating dirt and digesting the organic matter in it. The material swallowed, after being pulverized in their chickenlike gizzards and subjected to the chemical changes of digestion, is passed out in the form of castings—nature's original fertilizer.

A thousand adult worms will produce approximately fifteen pounds of castings in a week, and the average acre of healthy soil, it is estimated, contains 1,500,000 earthworms. All are tiny mills turning otherwise waste material into plant food. Add to this the fact that earthworms, working to a depth of six and sometimes even ten feet, bring new dirt to the surface and that their tunnels provide air shafts and watering tubes for the soil. By breaking up the dirt continually, they plow and cultivate the land.

In one of his experiments, Dr. Oliver obtained a dramatic demonstration of the value of these creatures to plants. In two pots of the same size and filled with similar soil, he placed two plants. Everything was the same except that the earth of one pot contained worms, the other did not. Although he repeated the test over and

over again, invariably the plant in the pot containing the earthworms grew faster and was stronger and healthier. A million worms in an acre of garden soil, he estimates, are roughly the equivalent of three skilled gardeners, working twenty-four hours a day in eight-hour shifts, plus ten tons of rich manure added to the soil each year.

Dr. Oliver's interest in earthworms dates back to his boyhood on his grandfather's farm in Ohio. For many years, his grandfather tried to convince his neighbors that they ought to plant earthworms as they planted seed. He conducted experiments to prove the value of worms to farm land. Later, when Dr. Oliver had become a prosperous surgeon in Fort Worth, Tex., he tried out his grandfather's ideas and was amazed at the effect. He achieved such extraordinary success with anything he planted that friends asked him to improve their lawns and gardens. His earthworm hobby became a full-time profession when he was called to California to advise Hollywood stars and other wealthy persons on the care of their estates. In addition to producing



Earthworm egg capsules. They are about one sixteenth of an inch in diameter

new kinds of worms for special work, Dr. Oliver has developed a process for recovering earthworm egg capsules from the soil and planting them like grass seed where they are needed. He has also prepared a new kind of concentrated liquid fertilizer by percolating water through earthworm castings.

Probably the most unusual earthworm activity of all is the "intensive range" feeding plan worked out by Dr. Oliver for use on poultry farms. Worm beds are planted in the earth of floorless chicken coops, large enough to hold 100 birds. When they have become well established, grain seed is scattered over them. Ten days later, when the grain has sprouted, the chickens are turned into half the area. They eat their fill of grain and worms for a week and a half. Then they are shifted to the other side of the coop while the first area is replanted. Thus the food supply is maintained at slight expense.

But that is not all. The grain-and-worm diet produces seeming miracles. At the age of five months, pullets are fully feathered. By seven months, they weigh five pounds and are producing eggs like mature hens. At the present time, a number of poultry raisers in the west are trying this "perpetual motion" plan based on the work of earthworms.

How concentrated liquid earthworm fertilizer is prepared. Water percolates through tiers of breeding boxes, each containing 1,000 to 3,000 earthworms, and drains to a trough



Preparing compost for the propagation of earthworms. The worms are started by planting eggs



Extended by the pilot before landing, the wing tips steady a plane

Plane's Wing Tips Slow Landings

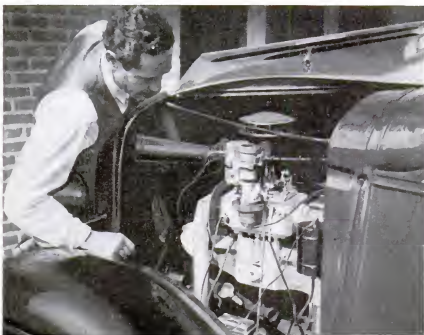
SAFE airplane landings at speeds as low as twenty miles an hour are said to be made possible by retractable wing tips invented by Charles Laurent, a French pilot. As pictured in the photograph at the left, the extra tips are built into slots in the ends of the wing, and are mechanically controlled so that they can be moved outward, forming extensions of the wing surface to increase the lateral stability of the plane at slow speeds.

All-Season Quilt Is Air-Conditioned

LIGHTWEIGHT quilts that will keep sleepers cool in summer as well as warm in winter, developed originally for use in hospitals, have now been placed on the market for the general public. By means of an electric fan, air that is artificially heated or chilled is blown through a flexible hose into the lining of the coverlet. Here the air is distributed evenly over the entire area of the quilt through branching air ducts, finally filtering through the porous inner lining.



Either warm or cool air can be fed into tubes inside this blanket



The double carburetor installed. It cuts fuel costs on long hauls

Special Carburetor Uses Oil or Gas

DESIGNED to cut the cost of operating truck and boat engines, a new double-duty carburetor automatically switches over from gasoline to furnace oil at ordinary driving speeds and back to gasoline whenever the motor is idled. A special exhaust manifold encircling the unit heats a miniature "cracking" plant which is said to change ordinary low-cost furnace oil into a practical fuel that can be fed to the engine through the regular intake valves. The change from one fuel to the other is controlled by a thermostat. Installation of the unit is said to be simple.

Leader Twirls Dials To Conduct Band



Buddy Wagner leading his electric orchestra. Sound comes from loudspeakers

Each instrument has its dial by which he regulates its tones

INSTEAD of waving a baton, Buddy Wagner, New York dance-band leader, twirls dials and levers on a control panel to mix the tones and adjust the volume of each section of his novel electrified orchestra. Crystal pick-ups are attached to each instrument, and the music produced is amplified and then wired to three loudspeakers set in front of the electric swing band, as seen in the photograph above.



The blind inventor of the new writing aid for the blind demonstrates its use

Writing Board for the Blind Keeps Written Lines Straight

PARALLEL guides stretched across a writing board make it easy for blind persons to write legibly without having their lines waver and run into each other. A sheet of paper is placed on the board beneath the guides, which limit the strokes of a pencil or pen, as pictured at the left. The simple device was invented by a naval chaplain recently stricken with blindness.

Work Glove Gives Nonskid Grip

MADE to fit either hand, a work glove designed for use in factories and industrial plants insures a strong, nonslip grip and at the same time affords protection to a workman's hand. Steel ribbons are woven into the leather base of the glove in such a way that they will not penetrate the leather nor loosen, even under heavy stress. The new hand guard is expected to prove specially valuable to steel workers and others in heavy industries.





Novel Cigarette Holder Keeps Smoke from Eyes

IF SMOKE gets in your eyes, or you are warned to stay away from cigarettes, you may welcome the solution to both these problems adopted by the Englishman pictured above. Using a length of semiflexible metal tubing to put distance between his cigarette holder and its mouthpiece, he heads upwind to read his paper, undisturbed by falling ashes or eye-watering tobacco smoke.

Liquid Rust Preventive

AVAILABLE in four different types, a liquid rust preventive recently placed on the market is said to have many qualities not found in ordinary protective coatings. Easy to apply, the coating is sprayed or brushed onto metal parts to prevent the formation of rust during shipment or storage, and can readily be removed if desired.



Applying the liquid coating to metal with a spray

Phonograph Plays Sound Film Records

A PHONOGRAPH that reproduces musical selections recorded on sound film is now being manufactured in Japan. The thirty-five-millimeter sound film used with the device accommodates ninety separate sound tracks with a total length of almost three quarters of a mile, and provides continuous playing for thirty-six minutes, in contrast with an average of four minutes for ordinary twelve-inch disk records. A turntable is also provided in the instrument for reproducing selections not yet recorded on film.



Sound film used in this phonograph plays continuously for thirty-six minutes



"Water Auto" for Police Hits High Speed

LIKE a streamline automobile without wheels, the odd "water auto" shown above in a trial run along the Thames River in England, can hit a top speed of thirty-five miles an hour although it is driven by a motor rated at only nine horsepower. Designed especially as a police patrol boat for emer-

gency work on the waterfronts of large cities, the craft has its engine forward and a three-place passenger cabin perched over the stern. The center windshield section forms part of a hatch through which entrance is made into the cabin, which provides all the comforts of a luxurious motor car.

New Eye Test Gauges Judgment of Level

AN EYE defect that causes some persons to see things slanted that are actually level, may be the cause of certain types of plane crashes and automobile accidents, according to optical scientists at Dartmouth College, Hanover, N. H. A pilot suffering from this ailment, it is stated, might see a landing field on a slant and bank his plane accordingly on landing, only to find too late that the field was flat. To diagnose this condition, scientists of the American Optical Company have developed a special test apparatus in which a subject looks through eyepieces at a table which is tilted by manipulating wheels with the hands. When the subject has adjusted the table to what appears to be a level position, the examiner compares this position with the true horizontal and thus checks the subject's judgment.



"Is it on the level?" is the question the subject tries to answer

Model Yachts Train

By
ARTHUR A. STUART

IN THE Marine Stadium at Long Beach, Calif., where the world's crack oarsmen and yacht skippers performed during the 1932 Olympic Games, fifty boys and girls shove their model yachts into the wind for the start of a race. On the Pacific Ocean,

two miles off Long Beach, a score of the city's older youngsters lie along the gunwales of twenty yachts, fighting for position as they approach a course marker.

Through five classes of models and a dozen types of bay and ocean yachts, hundreds of school-age and older water enthusiasts become skilled yacht builders and sailors under a novel program developed by the city's department of recreation. Two thousand young entrants will sail 1,500 model yachts this summer. Since the yacht-building program was started in 1930, 3,000 models ranging in length from twelve to fifty inches have been launched. Scores of sinkproof flat-bottom boats for bay sailing and larger ocean-goers bear these model-trained enthusiasts over near-by waters.

As director of this unusual, large-scale hobby, Frank M. Davenport aims toward a single objective: safety on and in the water. "If we never win a race," he declared, "at least we will have taught thousands how to build something; how to swim, row, and sail; knocked a little pep out and pushed a little experience into them." But Davenport's model builders have won more than their share of races, including a national championship.



City Recreation Program Teaches Ways of the Sea in Park Lagoon Regattas

A forty-inch model yacht sailing before a spanking breeze. Above, the start of a race on the lagoon of the Long Beach Marine Stadium

Lean Skippers



From models the youthful sailors graduate into the Skimmer fleet. These are flat-battamed boats designed for sailing in sheltered waters of a bay

Under Davenport's supervision, Long Beach boys and girls begin to learn sailing and boats when they are only six or seven. "Practically every man and boy, sometime during his life, has wished for a boat," he explains, which is the reason the model-boat shop was established nine years ago.

Before gouging into his first block of wood, each boy must pass a swimming test. Water safety is constantly stressed. Then he designs and shapes the hull, cuts and sews sails, erects the mast and other rigging. At last, the model complete, he sits on the workshop floor and studies the sails as they fill with air blown from an electric fan. Later he sits on the edge of a dock and observes eddying currents swirling around hulls of various shapes and sizes.

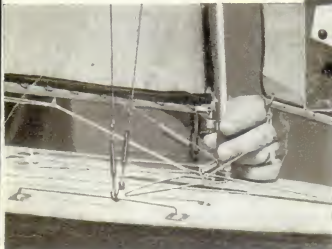
Ask any of these youngsters where he'll find dead spots in the sails under shifting winds, where pressures concentrate, where greatest slippage occurs, and likely he'll pop out with the right answer. He goes on, working with redwood or soft pine, to construct an eighteen-inch yacht, then a two-footer, thirty-incher, coming finally to the forty and



The skipper takes a lesson in aerodynamics, studying the effect of the wind on sails



This is a fine example of hull construction. At upper right, an instructor and a boy examine a hull. Right, rigging details including the sliding gear for balancing



Young model builders studying patterns of water currents swirling around three hulls of different shape. The upper photograph gives a close-up of the steering mechanism that keeps a model on a straight course

fifty-inch models. The last mentioned, known as the Marblehead class, becomes a little complicated, yet the youngsters have turned out forty-eight of these trim sailing ships.

Every two weeks, scores of model builders meet at the stadium to race their little ships. Each must be prepared to plunge into the water and swim out to his boat should she fall out of balance or take a wrong tack. Combination rowing and yachting sees them following the craft in rowboats, adjusting the sails at each turn of a triangular course. Thus they learn to row.

Not long ago, some of the model builders observed their boats misbehaving in a spanking breeze. Around the workbench a group took up the problem, and shortly A. R. Lass evolved a sliding rig designed to keep t' yachts in balance under all wind condition, no matter what course they might be sailing. Now each carries along the deck a spar which is held by a sliding chain plate, and the mast and other rigging in turn slide forward and backward, thus making it possible to balance a yacht in a few seconds.

These youngsters are constantly springing surprises which bring them trophies for fast sailing. Ted Thorsen and thirteen others rode into Berkeley, Calif., last year hoping to win the National "M" Class title with the 50-80

When a boat gets into trouble in a race, the owner usually plunges in and swims out to set it right



On triangular courses, boys row out to meet their boats at the turning points, to make necessary adjustments of sails

yachts. Thorsen had equipped his boat with a spinnaker and a vane gear intended to keep the little boat headed constantly in the pre-determined direction through the use of an airfoil connected with the rudder.

Only Thorsen's boat finished well the first day, the others wandering around the course like lost souls. That evening, Harold Teel suggested they rig the rest of the yachts sim-

ilarly. "In one night?" asked Thorsen. "Fast work, but we can finish the job before breakfast," declared Teel. Fourteen yachtsmen turned to the job, and by sunup had completed thirteen spinnakers and thirteen vane gears. As a result, Thorsen won the championship, and other Long Beach models placed second, sixth, eighth, tenth, and twelfth.

From models, many boys and girls move on to sailboats; first to flat-bottom Skimmers within near-by Alamitos Bay, then to larger



Girls go in for model racing too. These three are about to give their midget yachts a race-horse start

Getting her ready for the water—a common sight at the beginning of the boating season. Below, the hull of a new yacht built by a former model skipper is being lowered into the bay



yachts capable of riding out fairly heavy seas. Skipping a Snipe, Rainbow, Skimmer, Skimmerette, or Sunray becomes second nature, first learned with the self-sailing models.

Davenport keeps his finger on the larger yachts, too. Nothing gives Davenport greater pleasure than reports that some of his former model builders have attained excellence in sailing on the high seas. Stewart Henshaw, who built models three years, now skips a Skimmer. Fred Schenck sails his own Snipe. As for Harry Davis. . . .

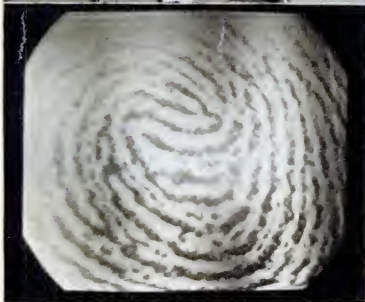
Davenport found this boy, then aged ten, learning to swim in a city pool nine years ago. He invited Harry to try his hand at model building. The boy passed the Junior

Red Cross life-saving tests, and Davenport handed him a small block of cedar. Harry proceeded to hew out the hull for a fine twelve-inch yacht. For two years the boy built small sailing vessels, then joined the Leeway sailing club for a little experience as a mate. He continued sailing, returning occasionally to construct scale models of boats he was sailing. Now he's a professional swordfish hunter, plying hundreds of miles up and down the Pacific; "one of the best sailors off this coast," according to Davenport.

Occasionally the boys encounter trouble. Gale Beardsley and five youthful companions offered to bring in a boat sinking near the Long Beach breakwater recently. They set out in a motor-sailer, and as they approached the derelict in the teeth of a forty-mile breeze, the propeller became fouled on the towing line. Young Beardsley ordered the sails up, but soon had to cut the wreck loose. Then his boat dropped its rudder. Unable to navigate, he saw the yacht drive against the rocks and begin pounding dangerously. Calmly, he ordered red flares lighted. Sometime later, Coast Guardsmen rescued the six shivering boys.

"He knew what to do and he wouldn't let us get scared," reported his crew on reaching safety. "Finest example of self-reliance I know about," said Davenport proudly. And a direct result of years of experience building and sailing models.

Fingerprints Transmitted by Television



Televising a photographic enlargement of a fingerprint. Left, the print as it appeared on the screen of the receiving instrument two miles away

camera, the fingerprint cards were turned over, revealing the photographs and names of their owners. In each case, the identification was correct.

THE feasibility of "telecasting" fingerprints for criminal identification was demonstrated recently in Los Angeles, Calif., by the Long Beach Police Department with the cooperation of experimental television station W6XAO. Photographic enlargements of fingerprints were placed before a television camera, and the images broadcast to a receiving set in a hotel room two miles away, where assembled police officials studied the prints on the viewing screen and tentatively identified their owners by reference to a file of prints. The names of the identified "suspects" were then telephoned to the television studio and, in full view of the television

Since the range of television at the present time is limited to distances under fifty miles, it would be impossible for police authorities throughout the country to televise fingerprints directly to the Federal Criminal Identification Bureau in Washington, D. C., but, police believe, officials in outlying cities could televise the prints of suspects to large centers, where the prints could in turn be sent by wire to Washington for identification. This process, it is held, would be much speedier than the present method of sending prints by air mail, and might enable a police department to hold a criminal suspect who otherwise might be able to free himself by legal means before his true and full identification and criminal record could be determined.

New, Two-Tailed



A visitor from the depths of space: the new comet as photographed at the Harvard Observatory on April 23, only a week after its discovery. Note the unusual structure of the tail

By DONALD H. MENZEL

PROFESSOR OF ASTROPHYSICS, HARVARD UNIVERSITY

ON THE night of April 16, 1939, a Norwegian amateur astronomer named Hassel happened to glance skyward, and an unfamiliar wisp of haze in the constellation of Andromeda arrested his eye. When a short check-up showed that the intruder was a true heavenly body, Hassel realized that he had found a comet. He reported the discovery to the nearest observatory, from which the news was relayed to the world.

Little or no information about Hassel is available at the present writing. But the comet he so fortunately discovered has proved to be the most brilliant since 1927, and perhaps the most widely observed since 1910,

when Halley's comet spread its fanlike tail across the heavens. Brilliant comets are rare. Only a small fraction of these objects attain naked-eye brilliance. That of 1927 was close to the sun and was seen by relatively few people. Although Hassel's comet cannot rank with Donati's, Halley's, or certain other great comets of the last century, it must nevertheless be given a major rating.

At maximum brilliance Hassel's comet was only slightly fainter than the North Star. Its light, instead of being concentrated into a single sharp point, was spread over quite an area, which made the comet appear somewhat less brilliant than it actually was. Several independent discoveries of the comet were made. Apparently it was first seen by two Russian amateurs, Jurluf and Achmarof, but the news of their discovery was not made

Comet DISCOVERED BY AMATEUR ASTRONOMERS

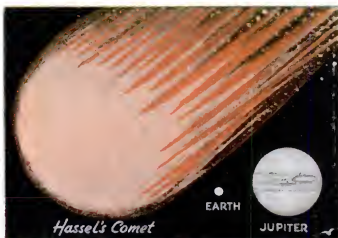
available immediately. Officially, the comet will be known to astronomers by the compound name of Jurlorf-Achmarof-Hassel.

In the latter part of February, and again in the latter part of June, the comet passed within a few million miles of the earth's orbit. Had the earth been in the neighborhood of either of these positions at the proper times, the comet would have been a magnificent naked-eye object. Its head would have appeared more brilliant than the brightest star in the sky, and its tail would have stretched halfway across the heavens. Actually the comet never came nearer the earth than about 70,000,000 miles.

It is difficult to state any precise dimensions for the various parts of a comet. Neither head nor tail possesses a sharp boundary. Where a short photographic exposure will show the comet as relatively small, a long exposure will lead to the recording of faint extremities and the comet will therefore appear larger. The comparative size shown in an illustration is only representative. It is obvious that the comet is a very extensive object. The total amount of matter in a comet is nevertheless extremely small.

The comet's head is believed to consist of a nucleus of meteoric matter—rocks and fragments of dust—surrounded by a tenuous aura of gas. The pressure exerted by sunlight upon the material in this atmospheric fringe causes it to move away from the sun. The resulting effect is a cometary tail pointing directly away from the sun.

The gases shot out along the tail, like the smoke trailing behind a locomotive, are completely lost to the source. A comet, therefore, is always losing weight. Comets that return frequently to the solar neighborhood are quickly depleted. The tail is continuously changing in form. Hassel's comet, at certain

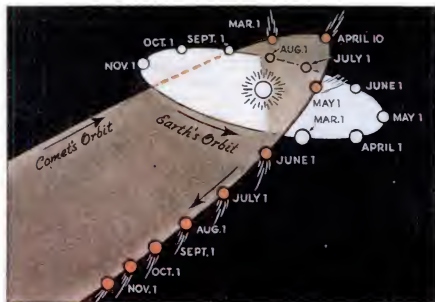


Approximate size of the new comet as compared with the earth and Jupiter, the largest planet

times, has shown a remarkable tail structure. On at least one occasion the comet appeared to have two tails. The effect may, however, have been produced by a hollow, cone-shaped tail, like the fine spray from a garden hose.

Analysis of the light from Hassel's comet shows that its chemical composition is like that of the comets of the past. Among the materials present are the lethal gases cyanogen and carbon monoxide. The occurrence of these materials in Halley's comet, when a collision was imminent between it and the earth, gave rise to the rumor that terrestrial inhabitants might be asphyxiated. Nonsense! A comet is so nearly a perfect vacuum that the added quantity of the lethal materials would be imperceptible.

Hassel's comet, having passed its nearest points of approach to the earth and sun, is now receding toward the depths of trans-planetary space, from which it came. Its orbit is probably a long ellipse. Eventually, some thousands of years hence, it may again return to the solar neighborhood.



A hollow, cone-shaped tail may explain the comet's double streamer. The diagram at left shows the relative positions of the earth and the comet as they passed in their respective orbits



A two-finger lever control in the plane's cockpit sets the tail-wheel brake seen at right, for a quick stop

Tail-wheel Brake for Plane Made from Bicycle Parts

DESIRING a wheel brake for his light plane, an ingenious Brooklyn, N. Y., flyer substituted an ordinary coaster brake of the type used on bicycles for the regular tail-wheel axle. Operated from the cockpit by means of a control cable that runs back through the fuselage to the tail-wheel assembly, the brake will stop the plane after a landing, even when there is a thirty-mile-an-hour following wind, and also can be used in place of wheel chocks to "park" the grounded plane.



Novel Display "Tries On" Specs

TO SHOW how various styles of eyeglasses will look on a person, the display shown below has six pairs of spectacles mounted on a revolving drum back of a semitransparent mirror. The observer, seated in front of the mirror sees a reflected image of himself with the glasses, visible through a mask screening the drum, apparently perched on his nose.



You can see how you look in glasses without actually putting them on



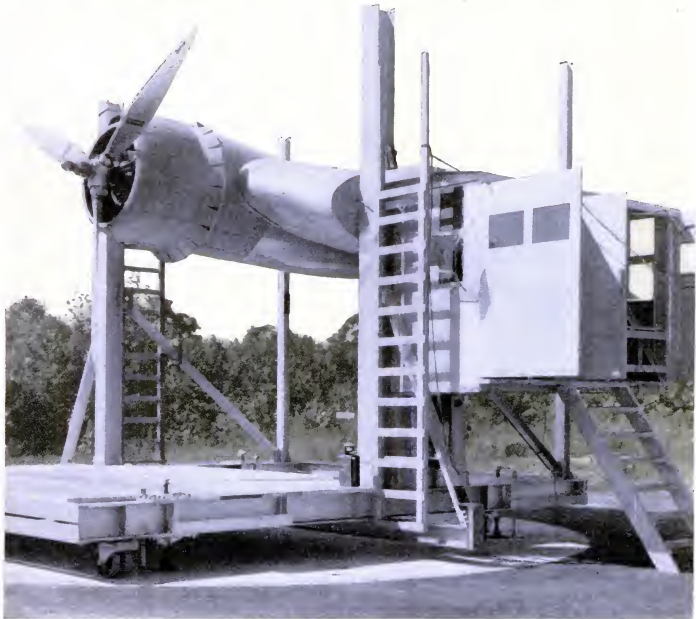
Knurled Tip Keeps Machine Screw from Loosening

SPECIALLY suited for use in machine parts that are subject to considerable vibration, a new type of self-locking machine screw has a cup point, and a knurled edge that serves to keep the screw from working loose. The manufacturer also claims that the screw may be adjusted repeatedly without impairing its locking qualities in the least.

Rig Tests Plane Motors

LIKE a gigantic windmill that furnishes its own breeze, a rotating test rig built by aeronautical engineers of the Glenn L. Martin Co., of Baltimore, Md., makes it possible to check the performance and flying characteristics of motors intended for airplanes of new design before the ships ever leave the ground on their test flights. An airplane engine, complete with its propeller and streamline cowling, is set into a nacelle in an airplane wing section. The latter is supported in flying position by a wooden framework extending up from a turntable, by means of which the running engine can be headed in a down, up, or across-wind direction. Mounted within an observation balcony placed on a level with the engine, an array of sensitive

instruments furnishes readings by which test engineers can analyze temperature and pressure conditions throughout all parts of the engine's fuel, cooling, and lubricating systems. A crew of specialists spends a month or more with each engine mounted in this rig, diagnosing and curing every fault affecting engine operation that might later cause trouble. Instead of leaving it to a test pilot to discover and report deficiencies in the power plant of the new ship, engineers using the rig actually produce many of the conditions a pilot would have to face in early flights. Four weeks of rig testing cuts down by an estimated third or half the number of hours of test flying that will be required before the plane is licensed for service.



Sensitive Meter Measures Light of Faint Stars

EMPLOYING a light beam only one hundredth of an inch in diameter, a new precision instrument developed by the department of astronomy at Northwestern University, Evanston, Ill., analyzes astronomical photographs to measure the brightness of stars that are 300 times fainter than those visible to the unaided eye, more than doubling the speed with which such measurements were formerly made. The device is used to forward a ten-year project of cataloguing more than 300,000 faint red stars, only five percent of which have been previously classified. Photographs of the entire northern sky are being taken section by section, and then examined in detail with the device.



Measuring the intensity of a faint star at Northwestern University



Rubber Paint for Tires

MADE with a rubber base, a new self-vulcanizing paint can be used either to renew the appearance of white side walls on tires, or to make black side walls white. Applied with a brush, the new paint dries quickly and can be washed with soap and water, with no danger of the paint losing its original whiteness. The product will not crack or chip, since it is elastic and flexes with tire movements.

Drill-Press "Wiggler" Locates Center Marks

WITH an ingenious "wiggler" it is a simple matter to locate centers accurately when drilling holes in machined parts with a vertical drill press. First, the work is centered by eye. Then the wiggler, consisting of a spring-tensioned pointer which fits in the drill-press chuck, is brought into contact with the center mark and the drill-press spindle is revolved. Any wiggle of the spring-tensioned pointer indicates that the work is off center and adjustments can be made until it runs true.



If the pointer wiggles, the work is off center

Robot Rowboat Aids Sea Rescues



The "electric fish" on its launching dolly. Right, controlling its movements from the switch box on the shore, by means of the cable

ON THE California coast, near San Francisco, the other day, a ten-foot, battery-driven fish charged through the breaking surf in a successful demonstration of a new aid to life saving. Behind the craft trailed a slender electric cable. By operating controls at the shore end of this cable, the inventor was able to maneuver the "electric fish" in any desired direction. Representatives of the U. S. Coast Guard were interested spectators at the tests. Because the craft is unmanned and can be guided from a safe vantage point on shore, it offers dramatic possibilities for carrying lines to distressed vessels without risking lives. Its range is far greater than the most modern Lyle gun, so lines can be sent to ships be-



yond the reach of present shooting methods. Known as the "Rice Runner," the new rescue boat is shaped like a torpedo. Both the batteries and the electric motors which drive the craft are housed in the water-tight hull. Consequently, the little vessel can plunge like a submarine through roaring waves during a storm without being disabled.

Inner Tubes Support New Surf Mattress



Two automobile inner tubes inflated within the fabric outer casing give a swimmer adequate support and can stand rough treatment. Punctures are easily repaired



BUOYED UP by two automobile-type inner tubes, a new "surf mattress" provides a wide variety of water sport. As a surfboard, it may be ridden lying down, or sitting astride as if on horseback. Its figure-8 design makes it easy for the most timorous bather to cling to, even in very rough water. With a paddle, it may be propelled like a boat. Sitting or kneeling on a pair of the mattresses, bathers armed with padded poles may stage exciting tilting

matches. Vents in the canvas cover, by admitting "water ballast," make it difficult to capsize. If one tube should spring a leak, the other has ample buoyancy to support an adult.



"Tulip" Bouquets Are Easily Made from Eggshells

SAVE those breakfast eggshells—and turn them into a bouquet of flowers! At left, the originator of the stunt shows how it's done. First, apply a decorative ring of colored sealing wax all the way around the jagged edge. Then, with more wax, attach each shell to a painted twig that serves as a stem. Finally, paint the shells inside and out with gay hues. The result is a vaseful of handsome, realistic artificial tulips that will astonish your friends when displayed on your living-room table.

Sealing wax, paint, and eggshells are the only materials of the flowers

The Man



EIGHTY-FIVE percent of the cost of a battleship is for labor.

EBONY is not always black.

FALLING asleep usually occurs in five different stages.

PICTURES on some hospital walls are now being changed frequently as an aid to relieving the monotony for patients.



NURSERIES now sell young trees grafted to produce five different kinds of apples.

BATS breathe only nine times an hour when hibernating; at the rate of 12,000 times an hour during moments of great activity.

PERFUMES have been known to stop wrist watches by affecting the lubricating oil within the mechanism.

EGGS with red-orange yolks are laid when hens are fed lobster shells.

**BE FEEDING US
FLAGS FOR
4TH OF JULY
EGGS NEXT!**



LOST RIVER, in Indiana, appears and disappears five times in its short course.

ONE SHOT killed 24,000 crows when Illinois officials recently dynamited an island in the Mississippi where the birds roosted at night.

RUSSIA has 12,000 women scientists.

SWING MUSIC is being used at a U. S. naval base in Hawaii to give rhythm to cargo handlers and prevent accidents in loading munitions.



Novel Eyeglass Sunshade

PATTERNED after the lens shade on his camera, the novel eye shade shown above has been devised by a student at Louisiana State Normal College. Fellow students declare his invention reduces eyestrain in studying. It consists of two conical shades fastened on spectacle frames and worn like eyeglasses.

Gauge for Machinists Measures Small Holes

A NEW type of precision gauge for internal measurements, introduced by a leading tool-maker, accurately gives the diameter of small holes in machinery. By turning a knurled knob at one end of the gauge, a split ball at the other end is expanded, until the sense of touch indicates a close fit. The gauge is then withdrawn from the hole, and the measurement transferred to a micrometer. A complete set of four gauges, shown below, will measure holes ranging in diameter from one eighth to one half of an inch.



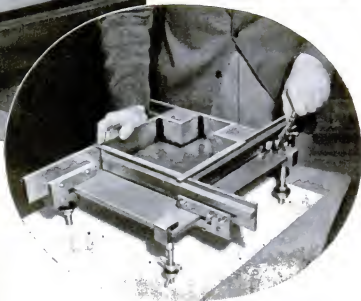
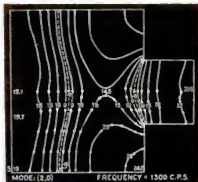
Turning a knob expands a split ball inside the hole

Freak Effects of Sound



MODEL ROOMS SHOW HOW SOUND BEHAVES

Dr. Richard H. Bolt with equipment he used in proving that sound is not dispersed evenly in a small room. The diagram below shows sound patterns created in the model room seen being assembled in the oval



By **ANDREW R. BOONE**

MINIATURE rooms of brass and fiber board, fashioned in a strange array of shapes, are helping to solve mysteries of sound in an underground laboratory at Los Angeles, Calif. Some of the models might be small-scale reproductions of your living room, or of a theater auditorium. Others, in queer geometrical patterns like parallelograms and trapezoids, suggest rooms such as a futuristic designer might create.

Using an oscillator, an electric device that emits a pure musical tone of a desired pitch, Dr. Richard H. Bolt, of the University of California, fills a miniature room with sound—just as a singer or musician might do in a full-sized concert hall. Then, by shifting the model about a stationary microphone connected to sound-measuring apparatus, he charts the loudness of the musical tone in each part of the model room.

Once it was imagined that sound diffused equally in all directions, on entering a room, and could be heard as well at one place as at another. In practice, expensive alterations have often been required in completed buildings to attain this ideal. Fundamental studies of the behavior of sound, now being carried on by Dr. Bolt and his colleague, Dr. Vern O. Knudsen, will help to determine the proper design in advance.

When a test on a model room is completed, Dr. Bolt records the results in a drawing crisscrossed by wavy lines, resembling those of a contour map and showing the "hills" and

Tested In Odd Laboratory

NOISE ELIMINATORS

A two-foot-square tank and a sound maker, shown at the right, revealed how air and certain gases deaden noise. Below, wire-mesh cylinders packed in mineral wool carry air but reduce sounds



"valleys" of sound intensity. Solid lines connect test points where the loudness is equal, and accompanying numbers show how far it exceeds an arbitrary standard in the units known as decibels. High-numbered lines, where the sound is loudest, may in extreme cases be "whispering galleries." Dotted lines

with minus numbers represent "dead" spots, like a theater seat where you can scarcely hear a word that is spoken on the stage. The fault cannot be corrected merely by changing the shape of a room, hit-or-miss, since Dr. Bolt's tests show that eliminating a "zone of silence" in one place may often set up a new one in another. The new studies are providing data for averting this.

Experiments on a larger scale confirm the tests with miniature rooms. Step down a passageway from the model-testing laboratory, and you will come to a "floating" room that rests upon a composite foundation of concrete, sand, and cork. An air space separates its foot-thick walls and ceiling from an

IN A SOUNDPROOFED CONCRETE CHAMBER,

Dr. Bolt and Knudsen test a noise-absorbing material. At right, close-up view of a noise baffle made from 8,000 hollow straws taped together



is reduced by putting any sound-absorbing material in the room. So perfect is the test chamber that even a hat, placed on the floor, observably diminishes the reverberation time.

There is a test to be made on a newly developed sound-absorbing material. A sixteen-foot square of it is laid on the floor. A wailing blast

of sound from the speaker is suddenly cut off. In eight seconds the sound dies away—three seconds faster than before. Where did it go? "These blocks are porous," explains Dr. Knudsen. "When a wave of sound hits them, it dashes into the holes like a breaker into rock caves on the seacoast. The energy is spent in tumbling about, and is converted into heat." You wonder if this suggests the possibility of heating with sound waves, but you are soon disillusioned: "Two million men speaking at once would furnish as much heat as a single 100-watt electric-light bulb."

outer concrete room. You enter, and its steel doors are closed. Now you could scarcely hear a cannon fired outside, but the buzzing of a fly in the room would be amplified almost to the roar of an airplane. The rigid walls of this "live room," as the experimenters call it, are surfaced with shellac to make sounds echo and reëcho as long as possible.

Dr. Bolt turns on a loudspeaker standing in a corner. It emits a sustained tone two octaves below middle C. While the sound continues, you walk diagonally across the room. At the corners of the chamber, the sound seems as much as four times as loud as at the center. This is the typical behavior of sound waves in a room, as shown by his models, Dr. Bolt explains.

He shuts off the loudspeaker. It takes exactly eleven seconds for the echoes to die away. That is "reverberation," you are told. Too much of it spoils any advantage gained in loudness, by making a speaker's words impossible to understand; you could hear him more plainly in the open air. Reverberation

WALKING farther down a long, dark corridor, you come to the experimenters' "dead room." Unlike the "live room," this test chamber kills sound almost as soon as it is created. Burlap-covered frames, containing padding of mineral wool, make it only one thirtieth as reverberant as the other.

A huge parabolic reflector in the "dead room" projects sound in a beam, like that of a searchlight. A four-foot square of pressed redwood bark is placed at an angle to the beam, for a test. An assistant holds a microphone to pick up and record the reflected

sound. He finds that the sample of wall material absorbs half the sound that strikes it.

At the hands of these investigators, sound waves are measured, mixed, steamed, dried, heated, and cooled like so much spaghetti in a vat. Some time ago, Dr. Knudsen found that results of sound tests on the same material varied from day to day. Seeking the reason, he discovered an unsuspected fact—that high-pitched sounds remain audible longer on damp days than on dry ones. Tests in cubical steel chambers of two to six-foot size proved that the phenomenon was not due to effects of humidity on the walls, but that the moist air itself was directly responsible; the molecules of water vapor in it made the difference.

Odd problems come to the sound wizards for solution. Not long ago, a large building was constructed in Los Angeles. When the blowers of its ventilating system were started, peculiar whistling noises entered its auditorium. Dr. Knudsen investigated, and designed a sound-absorbing duct, consisting of thirty

large-mesh wire cylinders packed in mineral wool. Sections of this construction, placed in the air outlets, banished the noises that had threatened to annoy audiences and make programs inaudible.

These supersleuths of the sound chambers do not confine their researches to sounds you can hear. They may investigate vibrations too high or low pitched for the human ear to detect. Since the science of acoustics embraces all mechanical vibrations, the investigators are seeking better ways to insulate buildings against those of traffic and machinery.

A slab of concrete, supported upon another by several layers of cork, aids this study. As a motor shakes the lower block, a young physicist holds a pick-up device alternately against the two blocks. "Sometimes," he says, "too much insulating material is as bad as too little." He removes part of the cork, and soon the upper slab appears to be motionless. Though this might not seem a problem in sound, it represents a study in acoustics, solution of which may mean the difference between bodily comfort and fatigue for thousands of workers in factories where machines throb and whirl from dawn until dusk.



SOUND IS DIRECTED LIKE LIGHT

in a narrow beam with this "parabolic" reflector developed by the experimenters for their research. Right, a student "listens" to two vibrating concrete blocks, separated by padding, to measure transmitted motion





Roller-skating de luxe. The hollow frame holds a hockey stick

Third Skate Lets You Coast Sitting Down

A THIRD skate designed for use with a hockey stick has a long, handlelike extension provided with an adjustable saddle which permits the roller-skater to coast sitting down, as pictured in the photograph at the left. A built-in brake, operated by means of a convenient hand lever, enables the coaster to slow down or stop easily. The hockey stick can be removed for use.

Machine-Belt Cutter Gives Square Ends

HANDLING leather, fabric, or rubber belts up to eight inches in width, a special knife unit now available insures accurate square ends when cutting a machine belt. The unit holds the belt snugly against a side guide, and the hand-operated knife is inserted through a slot that acts as a cutting guide.



With the belt held snugly against a guide, a cutting blade is inserted through the slot

Musical Cake Plays a Tune

IF YOU start to cut the first slice of your birthday cake, and the cake suddenly begins to play a tune, don't be alarmed. It's probably a musical cake of the kind introduced recently by a Brooklyn, N. Y., bakery. A diminutive music box is embedded in the bottom of the cake, and set off when a string is cut with the knife that cuts into the cake. Eighteen separate tunes are available, ranging from "Rockabye Baby" all the way to "Who's Afraid of the Big, Bad Wolf?"

Cut yourself a piece of cake and face the music. Below is the tiny music box that starts playing when the cake knife severs the string



"Beam" Detector Spots Distant Planes



Detector mounted in a plane for a test. It responded to objects fourteen miles away

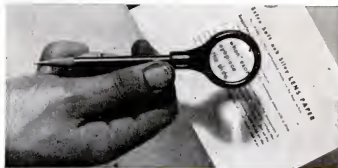
PROBING the sky with a soundless, invisible beam, an ingenious electric apparatus recently demonstrated at Floyd Bennett Field, Long Island, N.Y., by its inventor, Harry Dickens, spots the location of airplanes in flight, even though darkness, rain, fog, or snow make them invisible from the ground. Housed in a streamline shell of aluminum, with an odd antenna-like device perched on top, the device employs three radio tubes, a circuit of special design, a voltmeter, and a power supply consisting of dry-cell batteries furnishing a total of 180 volts. Although its operating details are secret, it is believed that the unit projects a slender directional radio beam. When this strikes an object, such as a plane, part of the energy of the beam is reflected back to its source, causing the voltmeter needle to fluctuate, thus indicating the presence of the plane in the direction toward which the apparatus is pointed. Taken aloft in a recent test demonstration, the device successfully picked out the Trylon tower at the New York World's Fair from a distance of fourteen miles and an altitude of 3,000 feet. Obviously of great military value in anti-aircraft defense, the device could also be used to avoid collisions between planes in the air, or ships at sea, and should make it impossible for an airplane pilot to crack up a plane against the fog-shrouded side of a lofty peak.



As a passing plane crosses the projected beam, it is reported by the voltmeter seen on the ground at left

Magnifier Fits on Pencil

SLIPPED onto the eraser end of a pencil, a small magnifying glass just placed on the market should prove handy to hobbyists interested in stamp collecting, photography, geology, and other fields.



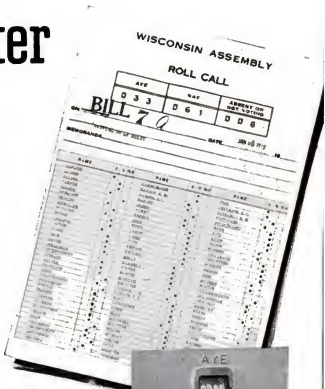
The pencil serves as handle for the magnifying glass

Electric Vote Counter

SPEEDS LEGISLATION

VOTING on bills introduced in the Wisconsin State Assembly in Madison is speeded by an electric vote counter and tabulator installed to eliminate tedious and time-consuming roll calls. Set up at a total cost of \$40,000, the intricate apparatus, employing thousands of sensitive electrical relays and switches, enables assembly members to vote by pressing a button, tabulates the totals of those in favor of and those opposed to a proposed measure, and even punches out a record of the vote for the legislative archives, showing how each member voted on the proposition. When a vote is called for, the clerk of the assembly presses a master button which "opens the rolls." Members select the "aye" or "nay" button from a circular panel installed on each desk. The results are revealed instantly on two electric signboards, one on each side of the chamber, by means of green and red lights, representing affirmative and negative votes, which flash opposite assemblymen's names on the board. At the same time, a counting device figures the totals, after which a permanent record is punched out. If a member inadvertently presses the wrong button, or wishes to change his vote before the rolls are closed, he can press a release button on the panel, which wipes his vote from the record, and vote again.

Each assemblyman has his voting buttons (circle, below) on his desk. Red or green light on roster shows his vote



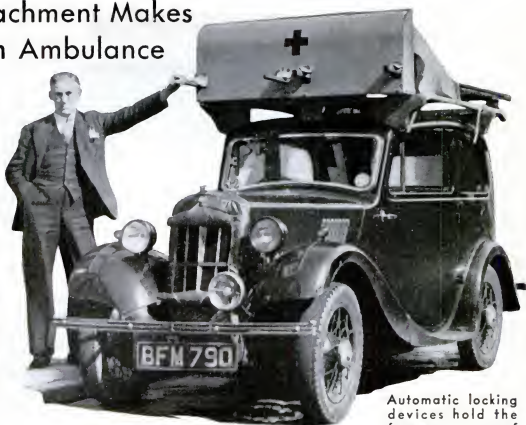
A tally sheet after assemblymen have voted. Right, total indicator on clerk's desk



The chief clerk of the Wisconsin State Assembly opens the roll for a record vote, while the voting-machine operator beside him mans the controls. In addition to saving time, the apparatus avoids danger of errors

Roof-Top Attachment Makes Any Car an Ambulance

IN EMERGENCIES, any sedan-type automobile can act as an improvised ambulance, with no alterations, drilling, or even damage to the finish of the car, by the use of a device invented by H. C. Lunt, of Cheshire, England. A wooden framework, attached to the top of a car by means of automatic locking devices, is constructed to accommodate two stretchers of regulation size. Straps hold patients securely in place during their car-top ride to the hospital in the novel emergency ambulance.



Automatic locking devices hold the frame on a car roof

Rotary Screens Keep Fish out of Canals

TO PREVENT young salmon, headed downstream in the Yakima River, in Washington, on their way to the Pacific ocean, from being sidetracked into irrigation canals leading off from the river, the U. S. Bureau of Fisheries has blocked the canal entrances with what is

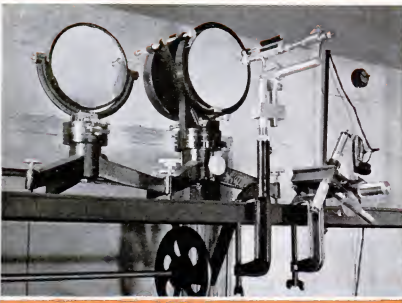
said to be the largest battery of rotary screens in existence. Their passage blocked by the screens, the fish are led through by-pass canals back into the river to continue their seaward journey. The screens are turned to prevent them from clogging.



Young salmon are detoured away from irrigation canals by these screens, which revolve to avoid being clogged

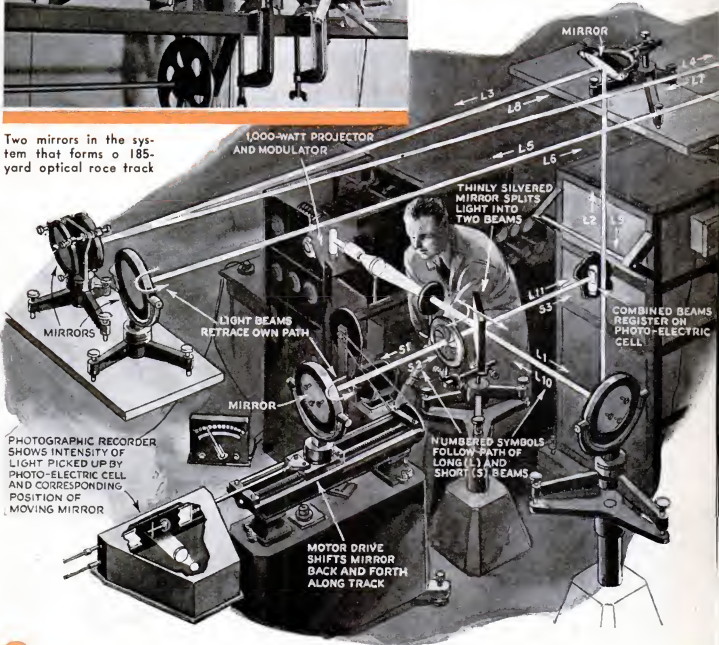
186,264

NEW INSTRUMENT MORE ACCURATELY



Two mirrors in the system that forms a 185-yard optical race track

The diagram below shows the arrangement of apparatus by which racing light beams are made to register their own velocity



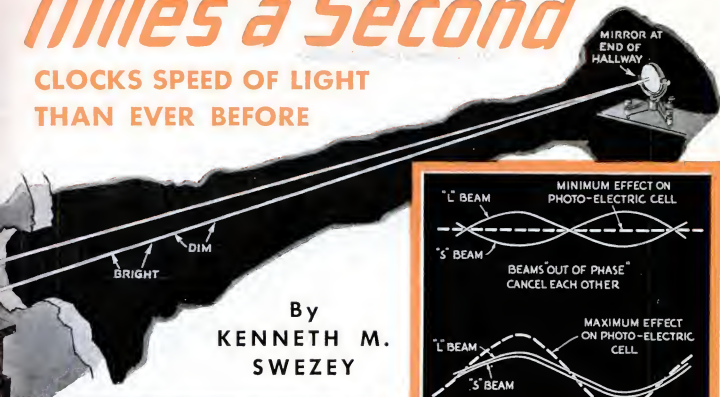
STREAKING back and forth across a small laboratory room and hallway at Harvard University, nearly 2,000,000 times a second, light rays are being made to check their own velocity in a new light speedometer believed to be the most accurate ever built. Developed by Dr. Wilmer C. Anderson, the new instrument can check this fastest velocity

in the universe with an error of less than two and a half miles a second—about five miles a second closer than the device of the late Dr. A. A. Michelson, which employed rapidly rotating mirrors and a mile-long vacuum tube.

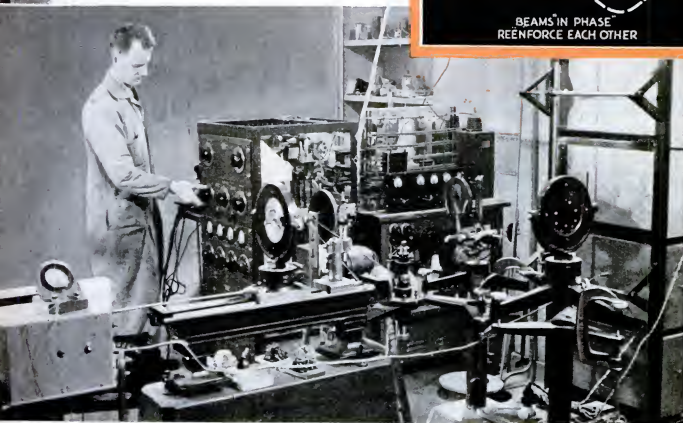
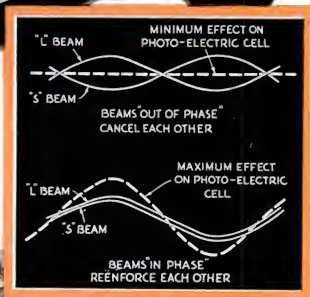
For 300 years scientists have been grappling with the problem of timing the speed of light waves. The Italian astronomer Galileo

Miles a Second

CLOCKS SPEED OF LIGHT
THAN EVER BEFORE



By
**KENNETH M.
SWEZEY**



Dr. Wilmer C. Anderson in the small laboratory at Harvard University where he has achieved the 300-year-old dream of science by putting an accurate stop watch on the fastest thing an earth. Inset shows the photographic record of light intensity that gives the final clue on which he bases his calculations

made the first attempt by trying to measure visually the time taken for lamplight to travel the distance between two mountain tops. Olaus Roemer, a Danish scientist, made the first successful measurement, in 1678, by observing that the light from the moons of Jupiter took about twenty-two minutes to cross the earth's orbit. He concluded that

light traveled about 192,000 miles in a second.

During the last fifty years, increasingly precise measurements have been obtained by laboratory methods, utilizing rapidly rotating mirror systems and beams of light reflected back and forth along lengthy paths. Strangely enough, however, the results of these measurements have been highly irregular, varying

as much as several hundred miles in a second.

The Anderson apparatus differs from all preceding light speedometers in that it has no rotating mechanical parts, that it has a comparatively short light path, and that visual observation is not necessary—the light itself being forced to help take the record.

The beam of light to be measured originates in a 1,000-watt projection lamp, from which it passes through a Kerr cell, a sensitive modulating device which causes the intensity of the beam to fluctuate from bright to dim 19,200,000 times a second. With the frequency of the manufactured light waves known, the chief problem is to determine the exact length of these waves. For velocity is merely frequency multiplied by wave length.

The fluctuating beam is split in two by a thinly silvered mirror placed at an angle across the light path. By means of a system of mirrors, one part of the beam is made to streak back and forth, across the room and down an adjoining hallway, over an optical race track about 185 yards long.

The other half of the beam is directed over a shorter path, about two yards long, the length of which is slowly varied by means of

a precision screw during each measurement.

After traveling their different courses, the two beams are finally brought together again, and the combined beam focused on a photoelectric cell which translates the light intensity into electrical impulses. The intensity of these impulses is automatically recorded on a strip of photographic paper which travels synchronously with the short-path mirror.

The basic clew to the wave length is given by the intensity of this reunited light. Because of the differences in the course lengths, the bright peaks and the dim valleys of the two beams no longer coincide. By varying the length of the short path, a point is reached at which the bright spots of one beam reach the cell at the same instant as the dark spots of the other. At this point they cancel each other, and produce a minimum fluctuation.

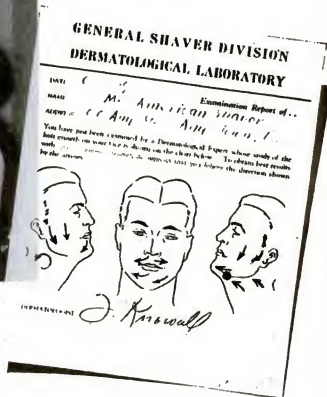
At minimum intensity the long-path beam is entering the cell exactly twenty-three half wave lengths behind the short-path beam. By dividing the difference of the two path lengths by this lag, the precise wave length is found. Multiply this wave length by the frequency, 19,200,000, and the answer, 186,264 miles a second, is the speed of light.

Beard Clinic Maps Strategy for Shaving



A dermatologist studying direction of hair growth under a subject's skin. The chart below tells how he should shave

HOW men should manipulate their razors to give themselves a smooth, clean shave is explained by dermatologists at the New York World's Fair after a facial examination with an ingenious apparatus. On human faces, the experts say, the beard grows in different directions, which should be followed by the shaver as he uses his razor. To determine hair directions on a subject, a dermatologist observes the face through a magnifying glass fitted with a light-polarizing screen. Colored



lights then enable him to look below the skin surface of a clean-shaven visitor and study the direction of beard growth on all parts of his face. Findings are marked on a chart.



This is how you look as you use the new instrument below to strengthen the muscles of the eyes

New Instrument Makes Eye Muscles Stronger

ALTHOUGH it might well be some particularly avid photographic fan having quite a bit of difficulty focusing his candid camera, the odd photograph above actually shows a patient strengthening his eyes with the aid of a new optical instrument developed recently by scientists attached to the research staff of the American Optical Company, in Southbridge, Mass. An ingenious and complicated arrangement of mirrors, lenses, and lights that combine to produce stereoscopic images, the apparatus is designed to put the human eye through a series of strengthening movements and thus build up weak eye muscles that are often the cause of crossed eyes and other defects of human vi-



sion. At the right, above, is another view of the stereoscopic optical machine which Dr. J. F. Neumueller, one of the research scientists associated in the development of the corrective apparatus, is adjusting for the benefit of a patient behind the instrument.

Simple Exercising Device Copies Tiger's Stretch

DUPLICATING the relaxing stretch of a jungle cat, a new exercising device consists simply of two rubber knee pads and a handlebar that slides along a horizontal metal tube placed at floor level. The user presses the handlebar forward until the body is in a prone position, and then returns to the starting position with the help of a spring built into the tube.

The handlebar slides along a metal tube until the body is prone



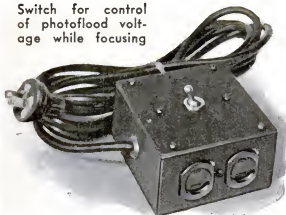
LATEST TIMESAVERS



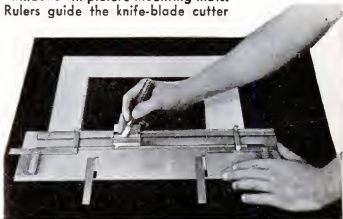
Novel Filtering Device Keeps Developer Clean

RESEMBLING a large hourglass, the apparatus shown above filters unwanted solids from developing solutions. One of its two identical bottles is filled with the solution. The other bottle is placed on top of it and screwed in place with a special filtering cap. The bottles are inverted and the solution filters through.

Switch for control of photoflood voltage while focusing



How the device is used to cut beveled "windows" in picture-mounting mats. Rulers guide the knife-blade cutter



Mat Cutter Simplifies Photograph Mounting

BEVELED-EDGE mats for mounting photographs can be cut easily and accurately with the cutter illustrated above. The cutting tool is guided by a carrier which slides along a rail locked in the desired position. As the carrier moves only between predetermined points, fixed by means of attached rulers, it is a simple matter to cut the opening to any size.

Enlarger-Lamp Regulator

HARDLY larger than the palm of your hand, a combination voltage regulator and voltmeter permits darkroom workers to use their enlargers at the rated voltages. Variations in voltage, laboratory tests have shown, often are responsible for lack of uniformity in enlargements. The new regulator permits line voltages to be increased or decreased in small steps so that a uniform voltage can be applied to the enlarger lamp.



"High-Low" Photoflood Switch

THE life of a photoflood lamp is said to be increased 1,000 percent or more by use of a compact new switch which reduces the current to half the line voltage when the lamp is being used for focusing. By flipping the toggle switch, the photographer can send all the current to the lamp and give it maximum brilliance while the exposure is made. The unit eliminates bothersome heat and glare during picture-making preparations.

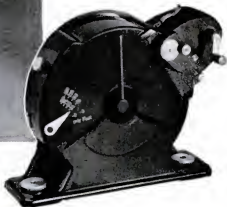
FOR CAMERA FANS

New Midget Camera Boasts Built-In Flash Equipment

WITH a photoflash reflector and a steadying handle as part of its regular equipment, a new inexpensive miniature camera has been designed to reduce night photography to its simplest terms. In taking after-dark pictures, no adjustments are necessary as the focus and the exposure are fixed. Releasing the shutter sets off the flash bulb while the lens is open. Supersensitive 35-millimeter film is used for night work. For daylight pictures, without the flash bulbs, a slightly slower film is used. Batteries are housed in the camera body.



Loading bulk film for miniature-camera use. Right, note footage indicator

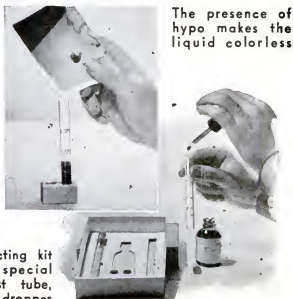


Safety Loader for Bulk Film

SPEEDY and safe loading of bulk 35-millimeter film into magazines for miniature-camera use is accomplished with the aid of a new light-tight container recently placed on the market. The unit holds 300 feet of bulk film. By inserting an empty magazine into a small chamber and operating a crank, the amateur can wind sufficient film for thirty-six exposures into the magazine. At any time, by a glance at two meters on the side, he can tell exactly how much bulk film is left in the holder and how much has been loaded into the magazine. An external knob permits closing of the magazine for removal. When the magazine chamber is open, a light-tight lock protects the film in the loader from fogging.

Handy Hypo-Detecting Chemical Tells When Films Are Washed

PROVIDING a quick and accurate means of determining if traces of hypo remain on prints and negatives after they have been washed, a compact chemical kit is a recent addition to the equipment available for amateur photographers. If hypo, used for fixing the image of a negative or print, is not washed away completely, it produces brown stains later on. The new kit contains a powerful chemical reagent. One drop placed in a test tube containing water turns the water blue-black. Into this dark fluid the last water draining from a washed print or negative is permitted to drip. If it contains hypo, the fluid in the tube becomes clear. The reagent will react to one part of hypo in 50,000 parts water.



The hypo-detecting kit contains the special test fluid, test tube, and a medicine dropper

POPULAR SCIENCE Question Bee

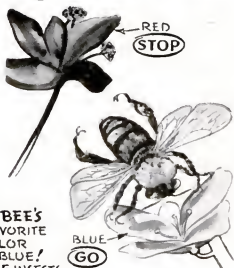
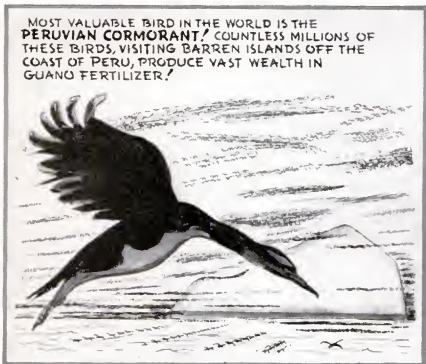
Here's your chance to see how much you know. Try to pick out the one correct statement in each of the paragraphs below. If you get sixteen right, you're doing well. Answers are on page 230



- 1 Photoflood lamps owe their brilliant light to (a) mercury vapor (b) an exceedingly high vacuum produced by a newly invented pump (c) overloading of the filament.
- 2 An octahedron is (a) a baby octopus (b) a man between eighty and ninety years old (c) a geometrical figure.
- 3 Poppet valves are found (a) on steam radiators (b) in the heart (c) on cornets (d) in automobile engines.
- 4 Like poles of magnets (a) attract each other (b) repel each other (c) heat each other.
- 5 The place on a radio dial where you will find your favorite station depends upon its (a) distance (b) frequency (c) direction (d) power.
- 6 To square any number, you (a) double it (b) multiply it by itself (c) write it inside a rectangle (d) discard all figures after the decimal point.
- 7 "Foot candles" is the name given to (a) torches carried in relays by Olympic runners (b) units for expressing brightness of illumination (c) candles burned by the ancients to measure the passing of time.
- 8 An underwriters' knot is used to (a) secure heavy loads on pack animals (b) tie sheets together to escape from a window of a burning building (c) prevent an electric-appliance cord from loosening at the plug.
- 9 The largest planet of the solar system is (a) the earth (b) Mars (c) Pluto (d) Jupiter (e) Mercury.
- 10 Increasing the diameter of an electric wire will (a) increase the resistance (b) decrease the resistance (c) have no effect upon the resistance.
- 11 The strange animal that is a mammal, has webbed feet and a bill like a duck's, and lays eggs is called a (a) platypus (b) okapi (c) wallaby (d) bongo.
- 12 An interferometer may be used to (a) detect illegal football plays (b) determine the diameters of stars (c) measure the interference between radio stations.
- 13 Household electric fuses are rated and marked according to their (a) useful life (b) candle power (c) amperage (d) heat of fusion.
- 14 Weather strips are (a) fastenings for reefing a sail (b) meteorological bulletins for aviators (c) material for closing chinks around windows and doors.
- 15 The science that artillerymen must know about is called (a) acoustics (b) ballistics (c) acrostics (d) semantics.
- 16 The British flag is commonly called the (a) Jolly Roger (b) Big Bertha (c) Long Tom (d) Union Jack (e) blue peter.
- 17 A galvanometer can be converted into an ammeter by adding a (a) battery (b) spark coil (c) buzzer (d) shunt (e) condenser.
- 18 A flux is used, in soldering, to (a) lower the melting point of the solder (b) provide a material that will conduct electricity across the finished joint (c) protect parts from oxidation.
- 19 A cycloid is (a) a small cyclone (b) the curved path traversed by a point on a rolling wheel (c) the interval between minimum and maximum sunspot activity (d) an instrument to measure the frequency of alternating current.
- 20 Potassium nitrate is sometimes called (a) calomel (b) orpiment (c) sal ammoniac (d) Glauber's salt (e) gypsum (f) salt-peter.

Un-Natural History *By Gus Mager*

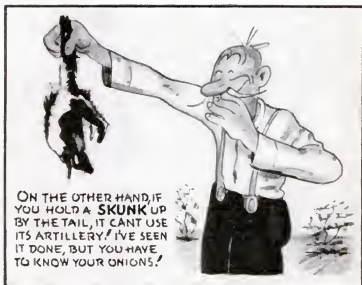
MOST VALUABLE BIRD IN THE WORLD IS THE PERUVIAN CORMORANT! COUNTLESS MILLIONS OF THESE BIRDS, VISITING BARREN ISLANDS OFF THE COAST OF PERU, PRODUCE VAST WEALTH IN GUANO FERTILIZER!



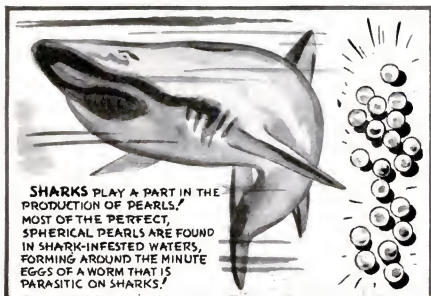
A BEE'S FAVORITE COLOR IS BLUE! THE INSECTS WILL GO FOR A BLUE FLOWER IN PREFERENCE TO ONE OF ANY OTHER COLOR! SOME AUTHORITIES EVEN SAY THAT BEES ARE ALTOGETHER COLOR-BLIND TO RED!



NEVER HOLD A SURGEON FISH UP BY THE TAIL TO HAVE YOUR PICTURE TAKEN! IT SPORTS A SHARP SURGEON'S LANCET WHICH POPS OUT OF A SOCKET JUST IN FRONT OF THE TAIL!



ON THE OTHER HAND, IF YOU HOLD A SKUNK UP BY THE TAIL, IT CANT USE ITS ARTILLERY! I'VE SEEN IT DONE, BUT YOU HAVE TO KNOW YOUR ONIONS!



SHARKS PLAY A PART IN THE PRODUCTION OF PEARLS! MOST OF THE PERFECT, SPHERICAL PEARLS ARE FOUND IN SHARK-INFESTED WATERS, FORMING AROUND THE MINUTE EGGS OF A WORM THAT IS PARASITIC ON SHARKS!



JUST AS THE GREAT CRESTED FLYCATCHER ALWAYS USES A SNAKE SKIN IN ITS NEST, SO THE WOOD THRUSH RARELY OMITTS A LARGE RAG OR PIECE OF PAPER IN ITS CONSTRUCTION!

New Conveniences



ROAST HOLDER. Believing that a bird in hand is worth two on the dining-room carpet, an alert manufacturer has put out the roast holder at the left to aid Fother in his regular Sunday bout with the chicken, turkey, or duck. Prongs on the chromium-plated stand hold a roast at a convenient angle for corving above the big metal tray

STAIN REMOVER. Ink and other stains are easily removed by the use of the handy brush outfit shown below. The stain is first moistened with water. Then a paste is spread over it from a special container on the back of the brush. After drying, the stain comes out readily when brushed over



THIN SLICES of bread for party sandwiches, Melba toast, and canapés are prepared with the device at right. A standard baker's slice is held firmly between two perforated plates and split with a knife

KEEPS BOTTLE WARM In the air-tight, sanitary container of the left, a baby's bottle is kept warm for three or four hours. Heated and placed in the container at bedtime, the bottle is still warm for the two-o'clock feeding

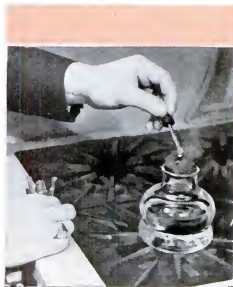


for Homemakers



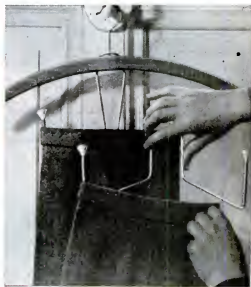
FISH-BONE EXTRACTOR. Bones of fish have no terrors for an eater equipped with this utensil. The fish is gripped between scissorslike forks which cut through the flesh and hold bones as meat is stripped off

WATERLESS "DOUBLE BOILER." The novel pan below offers the advantages of double-boiler cooking without the bother of an extra water container. A special bottom distributes the heat so evenly between the regular bottom and the sides of the pan that cereals, sauces, and other foods will not scorch



TO KILL ODORS, the flask at left is partly filled with water and a few drops of a liquid incense are added. Heated on the stove, the flask gives off a pleasing odor

TROUSERS HANGER
Creases are preserved in trousers with the hanger illustrated at the right. A wire loop is squeezed together and inserted in each cuff. When released, it springs back into shape



TEA-WAGON BARBECUE. Outdoor meals take on new charms with this barbecue oven mounted on wheels like a tea wagon. A metal cone holds a bed of burning charcoal, concentrating the heat on the cooking food. There is also a spit for turning fowls, which is operated either by hand or by an electric motor

Gus Wins



"Screwball Special" on a neatly painted shield on the car's radiator told part of the story

GUS WILSON is an energetic sort of fellow who gets through a lot of work in the course of a day, but he also is a fellow who believes in starting slowly—especially in starting the day's work slowly. Tackling a really hard job first thing in the morning, he is fond of contending, is as foolish as driving a car at fifty miles an hour before you get its engine warmed up.

In accordance with this theory of his of easy starting, he was standing at his bench a few minutes after eight o'clock on a fine summer morning, very deliberately laying out the tools

that he thought he was going to need for a routine repair job, and talking through the open office door to Joe Clark.

"It's a queer thing," he was saying, "that almost every time you see anything a little out of the ordinary, you'll see at least one more thing pretty much like it on the same day. For example, you don't often see a fellow with a black eye around this highly respectable burg. Well, I saw one on my way down here yesterday morning, and I saw two other peepers down town last evening. It's the same way in this business."

"Meaning —?" asked his partner in the

on Double Trouble

conduct of the affairs of the thriving little Model Garage.

"Meaning," Gus went on, "that if in the morning you happen to run into a job that's a little out of the ordinary, you'll get another one very much like it before the day's out. I've seen it happen again and again. Tell you what I'll do, Joe. I'll bet you even money that whatever job comes in here first this morning, we'll get another one of the same sort before closing time."

Experience has taught Joe Clark to be decidedly cautious about betting with his keen-minded partner. But he had been looking out of the office window as Gus talked, and now he grinned craftily. "I'll take you up on that, Gus," he said. "For a buck!"

"Huh?" Gus grunted, a little surprised. "Oh, all right."

Joe laughed outright. "Here's your first job," he said.

Gus looked up and saw a roadster that had just been pushed up to the shop doors by a battered old sedan. And what a roadster! Its breed was as thoroughly scrambled as that of the cheerful-looking mongrel pooch sitting sedately on its seat. A neatly painted shield on its radiator told part of the story: "Screwball Special." It was put together from parts salvaged from various junk yards, and Gus Wilson was one of the only two men in town who knew what automobile blood lines were represented in it—Chevrolet and Packard, Ford and Buick, Chrysler and Dodge, DeSoto and Stutz, and a dash of Auburn. The other man who knew the Screwball Special's ancestry was its builder and owner, Tim Sheridan, a young man who, in Gus's expert opinion, had more than a touch of mechanical genius in his mental make-up.

As Gus ambled up to the ark, the dog jumped over the roadster's door and ran to him, its tail wagging twenty to the dozen. "Hello there, Dodger," Gus said, patting its shaggy head. From the roadster there also emerged a tall, lean young man with big round spectacles and touselled yellow hair. Gus grinned at him. "Hello, Tim," he greeted. "That bunch of assorted grief of yours laid down and died at last?"

Tim nodded sadly. "Looks like she has,

Gus," he conceded. "The old gal's got me stumped. Thought I'd haul her around to you. You're the only fellow but me who understands her. And now I don't understand her!"

"Well, then," Gus told him heartlessly, "you'd better take her back to one of those junk piles you got her off, and let her rest in peace. She deserves it!"

Tim shook his head. "Don't you think it," he said. "There's a lot of thousands of miles of go in old Screwball yet—if I can get her started."

"What do you mean, 'if' you can get her started?" Gus wanted to know.

"Well," said Tim, "here's the whole sad story. Old Screwball's been running grand lately, except for one thing—a little trouble with the starter. So, a couple of days ago when I didn't have anything much to do, I pulled the starter off and took it apart. There wasn't anything wrong with it except that some of the parts were all worn out. So I went down to Sol Jacobson's junk yard, and began poking through his wrecks looking for a starter. I couldn't find one just like the one I had on Screwball, but I did come across one that was in swell condition, and that I thought I could use. And Sol let me have it cheap.

"THAT afternoon I got to work on the starter. I used most of my old parts, but I replaced the Bendix drive, and a few other parts, with the new ones. By evening I had everything set—or thought I had. But when I stepped on her, the starter whirled but nothing else happened. Nothing at all. So I pulled the darn thing apart again, and saw what a sap I'd been. The old Bendix drive had been a left-hand one, and the new drive was right-handed. Naturally, because of the direction of the rotation of the armature, the drive gear couldn't engage.

"Well, I cursed myself for a while, and then went to bed thinking that next morning I'd go out looking for a new left-hand drive. But before I got to sleep I had a bright idea. First thing in the morning I tried it out—just reversed the starting motor, which made the drive engage the flywheel!"

"Huh?" Gus grunted.

Tim Sheridan grinned sheepishly. "Sure—

MARTIN BUNN TELLS HOW GUS WILSON, SAGE OF THE MODEL GARAGE, GETS A DOLLAR FROM HIS PARTNER. IT'S NOT THE FIRST TIME GUS HAS DONE IT, NOR THE LAST

I was dumb not to have thought of it before," he admitted. "But I didn't."

"Well, I stepped on the starter. It spun the engine over all right—but that's all that happened. I kept stepping on it until I had run the battery pretty well down. Just about that time I smelled gas burning, and discovered that the carburetor was afire."

"Well, I put the fire out, and went to work on old Screwball again. I checked the ignition, and the valves, and the carburetor, and the coil, and the condenser, and even the intake manifold. I worked on it all day yesterday, but every time I stepped on her I got the same result—a sort of popping back through the carburetor that set it afire. So, you knowing old Screwball's constitution as well as I do, I hauled her over for you to have a look at her. She's got me stopped, I'll tell you!"

Gus laughed. "Get that starter off—that's all I want to look at," he said.

"But the starter's all right—it works fine now!" Tim protested.

"Sure—it works fine," Gus said. "Hey, Tim! What's gone wrong with your bean? Don't you see what you've done? By changing that drive and reversing the starter you've put together a starter that turns your engine over the wrong way. No, I don't want to see it work—I know!"

Tim shrugged his shoulders. "You usually do," he admitted as he went to work getting the starter off. A quick check showed that Gus was right. Then he pawed through the big box of old parts which he keeps in the back of the shop, and came up with a Bendix drive and a brush assembly which would fit Tim's starter. "There you are," he said. "Haul that conglomeration of old junk of yours out of here, and fix it up so that it can go on being a road hazard to respectable automobiles!"

"THANKS, Gus," Tim said. "You're a good guy. Say—don't go talking this around, will you? I don't want to be called Wrong Way Sheridan for the rest of my life!"

"Not a word," Gus assured him. "I wouldn't want to see you going around with your face as red as it ought to be!"

Tim whistled Dodger out of a comfortable nap under the workbench, hitched his car to his friend's battered sedan, and rolled slowly away in his Screwball Special. Joe Clark put his head in from the office door, an enraging

smile on his face. "Guess that'll hold you, Gus!" he gloated. "Swell chance of another job coming in today with something on it running the wrong way. That buck's as good as mine right now!"

"Maybe—maybe," Gus said.

Jobs kept on coming in and going out all day. Ordinary, run-of-mine jobs—batteries to be charged, light that wouldn't burn, spark plugs that were fouled, brakes that needed adjusting. Joe Clark kept an eagle eye on them all, and by mid-afternoon Gus was beginning to find his partner's triumphant grin intolerable. He had to admit—to himself but not yet to Joe!—that in all probability he had lost a perfectly good dollar.

Along about four o'clock a truck stopped in front of the garage, and a half minute later its driver's large form filled the shop doorway.

He measured a good twenty-two inches across the chest and fifteen inches through it, his nose had been broken and no one had done anything about it, and he fairly reeked of two-fisted masculinity. After one glance at this hard-looking new customer Gus growled: "Howya, Mac! What's your grief?"

"My engine is overheated—very badly overheated," the big driver said mildly. "I'd really appreciate it if you would get it fixed for me as quickly as you can. I'm terribly late, and my boss is going to raise Cain with me."

"Huh?" Gus gasped. "Oh, all right—I'll be as quick as I can. Got any idea what's the trouble?"

"No, I'm afraid that I haven't," the truck driver admitted. "Maybe I should have studied automobile mechanics instead of architecture—be of more use to me just now."

Gus laughed. "So that's how it is," he said. "Sort of tough—the way a lot of you boys just out of college can't get a chance to do the work you were trained for."

"I'm luckier than most," the driver said. "I'm going to have a job playing pro' football this fall. I'll make enough out of it to pay some surgeon for taking a piece of bone out of my shin and putting it in this bad nose, anyhow. But about my truck—"

"Drive it in," Gus told him, "and I'll have a look at it."

He checked the circulation of the water through the cooling system, the tension of the fan belt, and the valve and ignition timing, and found every- (Continued on page 224)

GUS SAYS:

There's no better time of year than right now to check up on your car's tires. They're winding up a season of warm-weather driving and if they weren't brand new at the beginning, they're a lot older now. Blowouts come mostly from worn treads and weakened tire walls.

THE HOME WORKSHOP



**Cash
Prizes**
for SPOOL
NOVELTIES

SEE PAGE 153

In This Issue.. GAS-POWERED MODEL PLANE • PHOTO HINTS
• SUMMER CRAFTWORK • ULTRAMODERN WORKBENCH

Miss Science

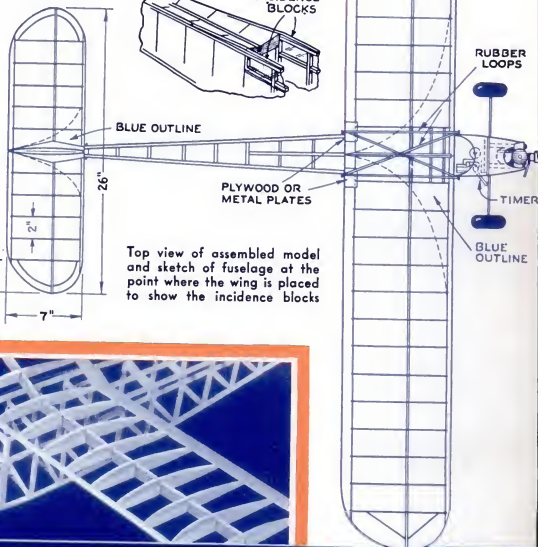
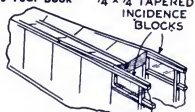
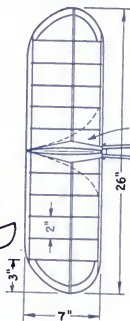
A GAS-POWERED MODEL AIRPLANE
DESIGNED FOR CONTEST FLYING,
BUT UNUSUALLY EASY TO BUILD

By FRANK ZAIC

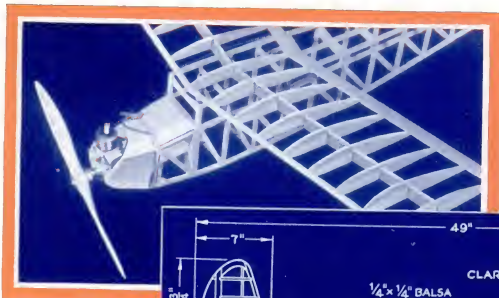
Editor of "Model Aeronautics Year Book" $\frac{1}{4} \times \frac{1}{4}$ " TAPERED
INCIDENCE BLOCKS

Specifications
WING AREA _____ 4.9 SQ. FT.
WING SPREAD _____ 6 FT.
PROPELLER _____ 14" DIA.
WEIGHT _____ 2 $\frac{3}{4}$ LB.
POWER _____ $\frac{1}{8}$ H.P. GAS ENG.

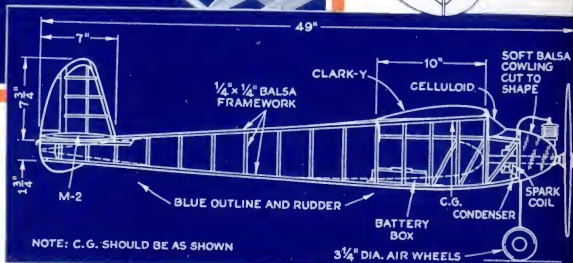
MODEL COVERED
WITH BAMBOO
PAPER



Top view of assembled model
and sketch of fuselage at the
point where the wing is placed
to show the incidence blocks



The framework with
engine and propeller
photographed before
the covering had been
applied. At right is
a side view of the
complete assembly



NOTE: C.G. SHOULD BE AS SHOWN

$\frac{3}{4}$ " DIA. AIR WHEELS



Model ready to launch. The cost of the materials, exclusive of the power plant, was \$5.25. Suitable engines range from \$10 to \$21.50

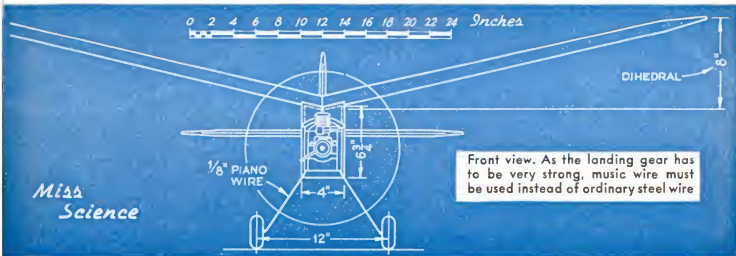
BUILDING a large model airplane powered with a miniature gasoline engine is almost as easy as constructing a medium-sized rubber design. A gas model, however, flies at about 20 m.p.h., so the slightest flaws show up, and this makes it necessary to be very careful in your workmanship.

"Miss Science" was designed especially for those who have never attempted a gas job, yet the model will qualify for all national and international competition and record requirements. Structurally, the design is of straight lines so that no trouble should be experienced in the correct angular setting for the wing, tail, and motor mount. Aerodynamically, the model is stable in all directions under normal flying.

The first step is to decide on the engine and buy the materials listed on a following page. The engine should be 1/5 h.p. and weigh between 6 and 8 oz. The complete flying weight of such engines is from 12 to 16 oz. when large flash-light cells are used. There are many engines now on the market that will fill these requirements, priced from \$10 to \$21.50. When ordering the balsa wood, specify rock-hard balsa for spars and long-erons, medium-hard sheets for ribs, and soft



Constructing the wing. The slots cut in the trailing edge for the ribs are being coated with cement





The wing tips are formed by cementing on wide sheets of balsa, which are then cut to a curve with the aid of a cardboard guide

Below is a photo of the model on the ground. Its covering of bamboo paper is finished with clear dope and then trimmed with blue



stock for cowlings. Use fairly thick cement and take extra pains with all joints.

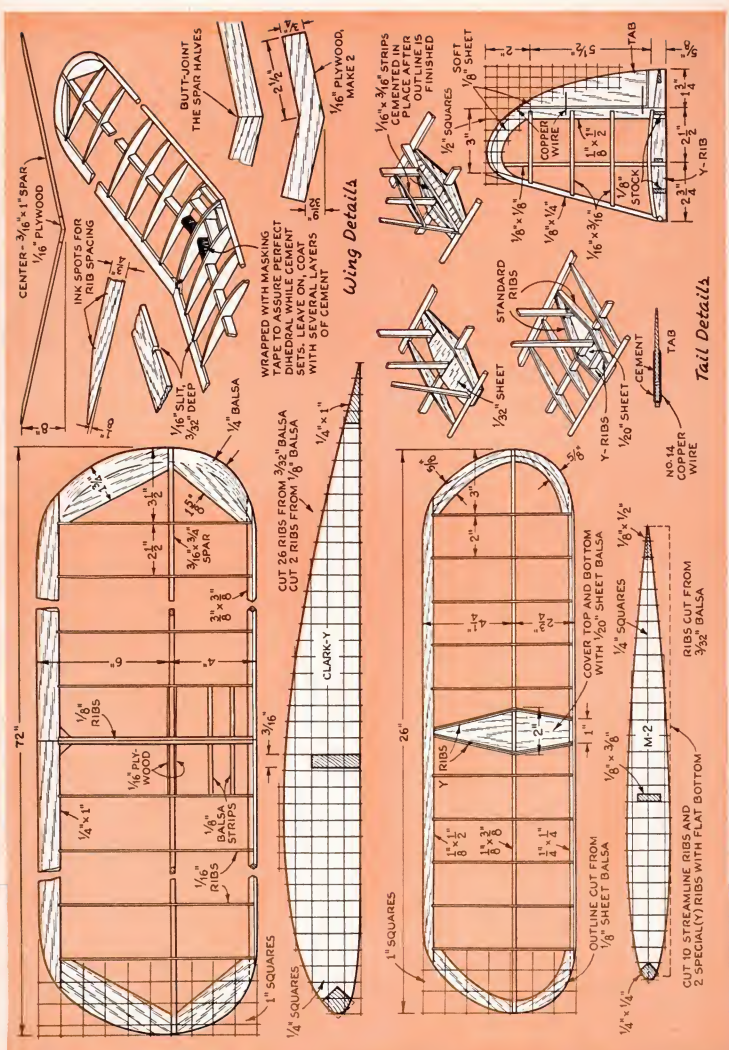
Fuselage. Make a full-size drawing of fuselage side on paper, tack to soft board, and coat all joints with soap to prevent cement from sticking to the drawing. Superimpose the top and bottom longerons over the outline and hold them in place with small brads. Carefully bevel the uprights for a snug fit before cementing to longerons. Make two of each upright, one for each side, to assure identical sides. When uprights are well set, fit in diagonals and window strips. Apply another coat of cement all over. Leave the side in the brad jig long enough to let the cement dry thoroughly. Make other side in same manner.

The two sides are assembled by first cutting the cross braces over a full-size top view. The braces that take care of the curved portion are dimensioned. Others can be marked directly from your full-size drawing since the taper from tail to just behind the wing is straight. Start assembling the sides in the rear where there are no curves. Check for true rectangular alignment. The curved portion is pulled in with rubber bands while the braces are drying. With braces in place, coat all joints again. Leave rubber bands while cement is drying. Shape the tail base and soft balsa block skid, and cement wire hook in place.

Motor mount. The plus or minus dimensions $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", and $9/16$ " will have to be

determined by the motor you use. Make the four $\frac{1}{4}$ " balsa uprights and notch them for the motor skids. Tack-cement them in place and fit the basswood skids. Check for parallelism and correct angular setting by laying an edge on them and sighting toward rear, and also sight from the side. When this is correct, recement the uprights permanently. While cement is setting, make the plywood outlines and drill mounting holes on the dural angle.

The mount is assembled by fitting the lower plywood in place, marking the three dural angle holes on it, drilling the holes, and bolting the angle in place. Be sure that you have the plywood strip in the rear of the bulkhead to press the balsa portion between the plywood. Replace the skids so that they protrude very slightly beyond the bulkhead B-B. Mark bolting holes through the dural angle, remove, drill, and replace by coating the joining or contact surface with cement and bolting them to the angle. Keep the rear end spread apart with balsa blocks as shown. The front is completed by fitting in place the top front plywood, rear horizontal blocks, corner braces, and several extra layers of cement all over.



Wing Details

Tail Details

Landing gear. Cut wire to length, mark bending points, clamp in vise, and hammer to desired angle. Be sure to get true piano wire; ordinary steel wire is not strong enough. When cutting wire, file nick all around, clamp in vise, and hammer until wire breaks. File away all sharp points. Wire is fixed to front bulkhead with 0.032" dural strap on top and wire binding on the lower portion. Coat all over with cement. When soldering nuts that keep wheels true, have the wire clean and sandpaper the surface before starting to solder.

Mounting engine. It is very important that you mount the engine exactly true. Bolt the prop in place. Place engine between skids. Mark one hole through the front lug hole. Remove engine, drill hole, replace engine, insert a bolt, and tighten the nut lightly. Turn prop to a horizontal position. Check for trueness by running a thread line from tail to each prop tip. Turn prop half a revolution to check trueness. Mark the other front hole,



In covering the wing, start by cementing the paper to the center rib. Hold the paper in contact with pins as required

remove engine, drill, and replace the engine. Bolt both sides and check before drilling the rear holes. Before tightening all four bolts, check again for trueness, and check even after the last nut is tightened.

With engine in place, cement soft balsa cowl blocks in place for carving. Note curve for windshield and slot for timer. The celluloid windshield and windows are cemented after covering.

Wing. Make full-size drawing to give spar and rib spacing and dihedral angle. Cut all ribs exactly alike. You can use a stiff paper template with fine wire running around the edges to keep the razor from cutting it. Shape trailing edge with plane, and note the rib slots to strengthen the joint and make line-up easy. Lay the two halves of center spar over the dihedral angle and cut the correct bevel at center. Also cut two plywood joint reinforcement plates. Cement them to one half of spar first; when set, insert the other half. Wrap several layers of masking tape around the joint and spread generously with cement all over. Also mark rib spacing on the center and leading edge spars.

Assemble wing by superimposing the center spar over the drawing and holding it in place with brads on both sides. You can block up the end that is in the air. Spread cement in the spar slots of the ribs and slip the ribs on the center spar over the rib lines. If ribs tend to wander towards one side, steady them with pins. When set, coat the angular cuts in front of the rib and press the $\frac{3}{8}$ " square strips against them. Hold in place with blocks at several points. The trailing edge is now

LIST OF MATERIALS

BALSA

| No. | Pc. | T. | W. | L. | Remarks |
|-----|-------|------|-------|-----|---------------------|
| 8 | 1/4" | sq. | | 60" | Hard stock |
| 2 | 3/16" | 3/4" | | 36" | Wing spars |
| 2 | 3/8" | sq. | | 36" | Leading edge |
| 2 | 1/4" | | 1" | 36" | Trailing edge |
| 1 | 1/8" | | 3/8" | 36" | Tail spars |
| 1 | 1/16" | | 3/16" | 36" | Rudder ribs |
| 6 | 3/32" | | 2" | 36" | Wing and tail ribs |
| 1 | 1/8" | | 2" | 36" | Tail tips, etc. |
| 1 | 1/4" | | 2" | 36" | Wing tips, etc. |
| 1 | 1/20" | | 2" | 36" | Stabilizer covering |

MISCELLANEOUS

| | | | |
|---|----------|---------------------------|----------------------|
| 2 | basswood | motor skids | 3/8" by 3/4" by 7" |
| 1 | pc. | 1/8" straight piano wire, | 30" long |
| 1 | pc. | 1/8" plywood, | 4" by 4" |
| 1 | pc. | 1/16" plywood, | 3" by 6" |
| 1 | pair | air wheels, | 3 1/4" diameter |
| 1 | pc. | 1/8" dural angle, | 6" long |
| 1 | pc. | 0.032" dural strap, | 1 1/2" by 1" |
| 1 | pc. | sheet celluloid, | 8" by 14" |
| 6 | | masking tape | |
| 5 | sheets | bamboo paper | 24" by 36" |
| 1 | can | of cement, | 8 oz. |
| 1 | can | of clear dope, | 16 oz. |
| 1 | can | blue dope, | 4 oz. |
| 6 | | rubber strand, | 1/4" |
| 1 | strip | bamboo | 15" by 1/4" by 1/16" |
| 7 | bolts | and nuts, | 4-36 by 1" |

POWER PLANT

1/5-h.p. engine and accessories, including timer, jacks, hook-up wire, batteries 14" diameter propeller

Note: The estimated cost of complete model, not including power plant, is \$5.25. This price is based on good quality material.

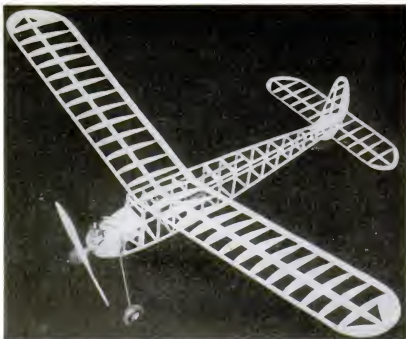
daubed with cement and pressed against the ribs. Let cement set well and trim leading and trailing edge at center for a clean butt joint with other half. Remove brads and start on the other half. Be sure to block the finished half so that lower portion of the ribs will be parallel with the board and both halves will have identical angles while flying. Make sure that you have perfect center butt joints before marking rib spacing on leading and trailing edges.

Wing tips are made by cementing wide balsa sheets as shown, and trimming them to a curve with the aid of a cardboard template. Finish wing by tapering the tip outline, reinforcing the center two panels, and coating all over with cement.

Tail surfaces. The stabilizer will give no trouble if you make all ribs accurately. Note the two special ribs' on center; these give a wide foundation to match the tail platform on the fuselage. Two standard ribs are cemented to them to make covering easier and cleaner. In constructing the rudder, line up the spars true and on center of stabilizer. Fix top outline in place before bending strips for streamline ribs. Strips abutting stabilizer will have to be cemented at an angle because of stabilizer curve.

Covering. Before covering, check all joints. Cover fuselage first to gain experience with bamboo paper. Use slightly dope-thinned cement. Cover the cowling balsa to obtain a smoother paint job. You need to coat only the longerons and the end braces or where strips end, and also the cowling balsa. The wing surfaces are covered the same way; that is, just the outline. Start by cementing the paper to the center rib. Be sure that cement is dry before spreading cement over the edges and end rib because you have to pull the paper to get a fairly smooth covering. Do not worry if paper bulges in a shallow way. Be sure to pat the paper to the balsa because bamboo paper is stiff, and you might even have to hold it in contact with pins. When all surfaces are covered, moisten the paper with a spray (such as a fly gun) or a soft cloth. In an hour's time the covering will be tight as drum, but while it is drying see that the wing is on a level board, one half lying flush and the other half blocked. If there are any warped places, now is the time to straighten them by appropriate blocking. Finish the job with two coats of clear dope. Cement the celluloid windshield and the two bamboo strips that hold the wing-fixing rubber loops. Outline the scallops with masking tape and brush on two coats of blue dope.

Finishing. Coil, condenser, and timer should



The framework before being covered. Every joint must be very carefully fitted and securely fastened with fairly thick cement

be fixed in place before covering. The wiring diagram shows the electrical connections. Be sure to solder all joints cleanly because more than half of all engine troubles develop from poor electrical wiring. Also make sure that batteries are firmly wedged in the box.

The center-of-gravity position is determined by the battery box. Assemble the model and place the box at the position shown on the plans. Tie wing in place with rubber, and place fingers at the c.g. position. Move the box as needed until model balances at the designated spot. When balance is achieved, fix the box base securely to bottom cross braces with cement and pins. The battery box itself is held with rubber and two crosspieces and base. It is very important that the box does not shift.

Flying. Before going to the field, make sure that the motor runs without trouble. We used regular size flash-light cells and did not need boosters to start our motor, but most new motors will start sooner if a strong battery is used, so run two wires from the battery to phone jacks on side. Plug in bell batteries to start. Note polarity. Check your timer and make sure that you know where to set it for ten seconds. Also have an idea just what settings are needed on spark timer and throttle for various speeds.

Pick out a windless day for initial tests. Tie wing in place with about two loops of $\frac{1}{4}$ " rubber over each side and diagonally. Make sure that it is on securely. The tail needs about three strands on each side. Check for line-up and position of wing in relation to fuselage. Sight along the rudder from rear. It should be straight in sighting on center of wing or spark plug.

Start testing by ground rolls. Face wind

and lift the model by rudder until fuselage is parallel to the ground. Run along and then shove the model level into the wind. The model should roll level and then rise about a foot into the air. If c.g. is as indicated, this should happen. If it tends to stall, check the launch and the c.g. If the c.g. is right and everything else in the correct place, decrease the angle of incidence by inserting small pieces of stiff paper under the trailing edge of the wing. If model looks fairly stable, you can start power flying.

Start power testing with very low r.p.m. and about a ten-second timed run. Guide the model by one wing tip as it gains speed. Be sure you are facing the wind. The ship should rise gradually and when power is out, it should nose down smoothly. Note the natural tendency to turn. It should turn to left under power. If model tends to stall under power, check the surfaces and incidence. If the glide

is good, try another flight before making changes. Now open the engine a trifle more, and note especially the turn. If the left turn is gradual under power and straight when gliding, you can help the left turn with rudder. You will find that if the model has slight stalling tendency, it will climb steadily while in a circle.

If the model turns sharp to left or right under power, check the thrust line. You might have to loosen the engine and put in a minute amount of right thrust and more left rudder, so that the model will circle left under power and glide.

After you have mastered the rudiments of flying, you can remove the $\frac{1}{4}$ " incidence strips for greater angle of incidence, but in conjunction with this change, you will have to incorporate down-thrust by raising the rear end of the engine with washers between lugs and mounts.

Wooden Trays Finished Like Porcelain



This tray, which is 16" in diameter, was turned from wood, enameled, and decorated with artist's oil colors

Making trays and plates is a simple faceplate job, but the finished work can be made most attractive, as in these two examples. "Decals" or transfers can be used for center ornaments



A STRIKING imitation of hand-painted porcelain may easily be obtained by the following method: From a piece of soft or hard wood about $1\frac{1}{2}$ " by 16" by 16", turn a large serving tray or plate. This can be done on the wood lathe with the faceplate screwed directly to the wood as the screw holes will not injure the piece to any extent. Sandpaper the work thoroughly and fill the screw holes with composition wood.

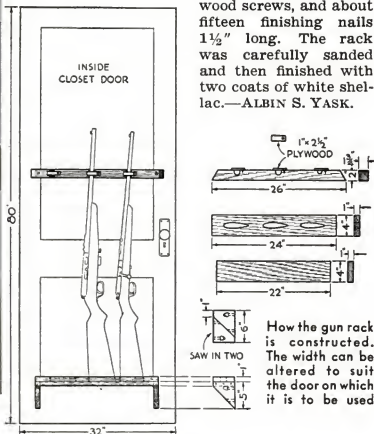
Give the piece a coat of flat white paint, and when dry, sand lightly with very fine sandpaper and dust well. Now apply three or four coats of a good grade of enamel, lightly sanding after each application. When the enamel work is finished, decorate by painting with artists' oil colors or by use of decalomania (transfer) patterns and gold or silver paint applied as stripes to the edge of the tray.—R. H. JENKINS.

Gun Rack Fastened to Closet Door



In an apartment or other crowded quarters, a gun rack can be fastened behind a closet door

WHEN space is at a premium and there is no room for a gun cabinet, as in an apartment house, it is usually possible to place a gun rack on the inside of a closet door. The one illustrated holds a shotgun and two target rifles. It required one piece of white pine 1" by 4" by 4' 6", another piece 1 3/4" by 2" by 2' 2", three pieces of plywood 1/4" by 1" by 2 1/2", three 1" wood screws, and about fifteen finishing nails 1 1/2" long. The rack was carefully sanded and then finished with two coats of white shellac.—ALBIN S. YASK.



How the gun rack is constructed. The width can be altered to suit the door on which it is to be used

HACK-SAW BLADES FOR VARIOUS MATERIALS [METAL WORKING]

Hand Blades

- 14 teeth — Brass, bronze, cast iron, heavy angles, rails, soft steel.
- 18 teeth* — Drill rod, high-speed steels.
- 18 teeth — Light angles, small solids.
- 24 teeth — Brass tubing, heavy BX, iron pipe, metal conduit.
- 32 teeth — Flush pipe, light BX, sheet metal, thin tubing.

Light Power Blades

- 14 teeth — Bronze, copper, iron pipe, wrought iron.
- 18 teeth — Copper tubing, light angle iron, thin metals.

Heavy Power Blades

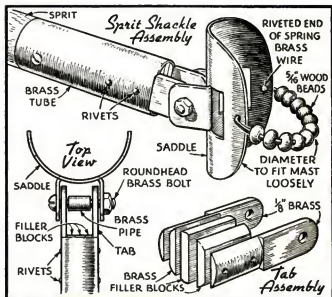
- 4 teeth — Large solid stock and die blocks.
- 6 teeth — Machine steel, soft steel, solid stock.
- 10 teeth — Brass, bronze, heavy angle iron, iron pipe, steel rails, tool steel.
- 14 teeth — Hard materials, steel tubing, light angle iron.

*A speed of 40 strokes per minute is recommended in this case, but 60 strokes per minute in all others. However, this speed applies to blades of tungsten alloy steel. When molybdenum or high-speed steel saws are used, the speed can be increased.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



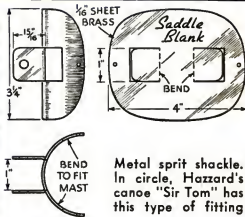
FOOLPROOF Metal Shackle HOLDS Canoe Sprit



THE most practicable method of getting mast height in canoe sailing rigs is by the use of the hoisting sprit or gaff. Little difficulty is experienced with the sprit rig if an efficient shackle is devised to hold the heel of the sprit to the mast. It must afford smooth motion up, down, and around the mast and must hinge to allow the sprit to come down on deck. A plain, properly curved wooden jaw will do these things if accurately fitted, but the metal shackle illustrated is perfection itself and is little more trouble to make than the wooden article.

The saddle, bent from 1/16" brass, should inclose half the diameter of the mast when in the lowered position. Before cutting the tabs to which the heel of the sprit hinges, it is a good idea to make a cardboard pattern. The tabs should measure slightly more than half the diameter of the sprit from center of hinge pivot hole to back of saddle. The cutting can be done with a jeweler's saw after holes have been drilled for the blade to enter. Bend the tabs back, round the edges, drill the pivot holes, and bend the saddle, using the mast as a guide. Hammer the metal judiciously to harden it, and then polish the surface.

The fitting at the end of the sprit is made by inserting pieces of flat brass within a piece of brass tube of a size to fit the heel of the sprit. The outer pieces forming the tabs should be of 1/8" stock as they must be rounded to fit the interior of the tube, into which they project about 1". Clean these surfaces, tin generously, line up the hinge holes



Metal sprit shackle. In circle, Hazzard's canoe "Sir Tom" has this type of fitting

carefully, wedge firmly with well-tinned pieces of flat brass and, after drilling and riveting the parts, sweat-solder all firmly together. There should be at least 3" of the tube clear for fitting on the sprit.

Cut a piece of brass pipe to fit snugly between the tabs of the sprit, slip into place between the tabs of the saddle, and secure with a roundhead brass bolt. Tighten just enough to produce a nonrattling joint. Saw off the end of the bolt and head over to prevent loss.

To keep the shackle from coming off the mast, a piece of spring brass wire is bent and riveted in place as shown after a number of wooden beads from 1/4" to 5/16" in diameter have been strung on it. To prevent sag to leeward, the sprit should lap the mast for about half the mast's length.—JACK HAZZARD.

Sidepieces for Sun Glasses Cut from Fogged Film



With this arrangement, side glare is excluded

SIDE glare may be eliminated from ordinary sun glasses or goggles by attaching shields cut from fogged or opaque negative film as shown. The film, after being cut to shape, is cemented to the frames of the sun glasses with either film cement, household cellulose cement, or model airplane cement.—**GEORGE H. HORST.**

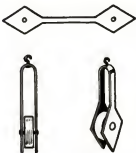


Repairing a Drill Chuck When It Starts to Slip

WHEN the chuck on a hand or breast drill starts to slip, it can be easily remedied as a rule. Remove the three small jaws from the chuck and oilstone the faces until the gripping edge is once more fairly sharp. Be careful, however, to keep the face angles the same as they were originally. This may be done by pressing the jaws together as the work progresses to check their fit.—**R.O.L.**

Metal Blocks for Ship Models

METAL blocks or pulleys for the topsail hal-yards of a ship model may be made by cutting thin copper or brass to the shape shown at the right. The sheaves may be brass, wood, or fiber. Drill the parts to take a pin cut to the right length, and assemble. Insert a tiny wire hook at the top. The sharp metal edges may be dulled with a file, if desired.—**S. P. ROBBINS.**

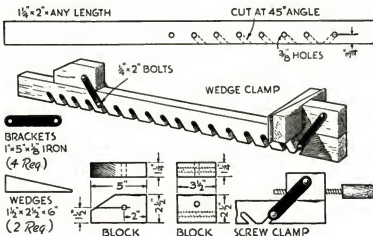


Narrow Brush Cleans Machines

VERY narrow brushes for cleaning out-of-the-way places in small, intricate machines may be made by splitting an old toothbrush lengthwise with a coping or fret saw. Leave one row of bristles on one portion and two rows on the other portion.—**R. J. JARVIS.**

WOODEN GLUING CLAMPS

[WOODWORKING]



ADJUSTABLE gluing clamps of any length can be made from hardwood as shown. Wedges may be used to apply pressure, but if a wood-cutting tap and die are available, it is more convenient to use a wooden screw unless the work is very thick, in which case the wedges are better. A pair of similar but smaller clamps with bars about 1" by $1\frac{1}{4}$ " by 24" are useful for repair work and small jobs.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

These spool novelties and the ones shown on page 141 were designed by Hazel F. Showalter to give contestants an idea of what can be done



What Can You Make from Spools?

YOU'LL find it a lot of fun to construct novelties from empty spools. Just try it. For our part, we'll make it interesting by offering the following cash prizes for the best designs our readers originate:

- FIRST PRIZE.....\$25
- SECOND PRIZE..... 15
- THIRD PRIZE..... 5
- FIVE PRIZES, \$1 EACH 5

To enter this friendly little competition, round up whatever empty spools you can discover about the house and see what you can do in the way of combining them to form comical animals, birds, figures, or inanimate objects. You will find a few suggestions on this page and also on the Home Workshop cover.

Each contestant will be allowed to enter only one project. This must be made mainly from spools, although any necessary accessories such as dowels, beads, wire, cord, nails, tacks, screws, glue, and paint may be used. The spools may be cut or shaped in any way, but the finished article should appear to be frankly what it is—a spool novelty. No model should be larger than 15" in its greatest dimension. Any entry which consists of a larger model or contains



more than one novelty will be disqualified.

Mail your entry, fully prepaid, to the Contest Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, to arrive on or before September 30, 1939. No entries will be returned. When wrapping your spool novelty, be sure to pack it carefully.

The contest judges will be the editors of this magazine, whose decision will be final. In case of ties, each tying contestant will be awarded the prize tied for. The contest is open to all except employees of this magazine.

A NEW FUN-PROVOKING PRIZE CONTEST

Small Washing Machine

The cover, inner tub, perforated wooden plate, and motor. The assembled washer is shown below. Designed especially for towels, babies' clothing, and the like, it works by forcing soapy water and air through them

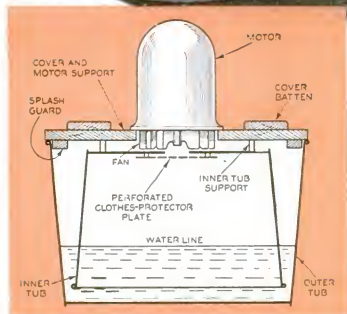


BY UTILIZING an old vacuum-cleaner and two small galvanized-iron tubs, it is possible to make a serviceable little washing machine for three dollars or less. Although not a substitute for a full-size washer, it is excellent for towels, sheets, babies' clothing, and the like. If made the size shown, it will handle the equivalent of two sheets, five shirts, or fourteen diapers, and the washing time is from ten to twenty minutes.

One tub should be at least 2" less at its largest diameter than the smallest diameter of the other one, and it must be at least 2" less in depth. For example, the outer tub may be 20½" in diameter and 11" deep, and the inner one 13" in diameter and 9" deep; or in case the tubs are sold by capacity, one might be 17-gal. and the other 12-gal., which are two standard sizes.

Make a cover of ¾" wood or plywood to fit over the large tub. Cut a hole in the center to clear the fan, and mount the motor on the cover as shown. Measure how far the fan protrudes through the cover, and make three or more supports to hold the inner tub upside down under the cover in a position that allows it to clear the fan. There should then be 1" or more clearance between the tubs at the bottom.

Before mounting the inner tub, cut a 2" hole in the bottom of the small tub. Over this fit a perforated wooden plate to prevent any clothes from catching in the fan blades. It is



How the parts are put together. The water level may require some experimenting to get it just right

By **QUENTIN BERG**

Built for Three Dollars

also advisable to fasten a $\frac{3}{4}$ " thick ring of wood under the cover and just inside the edge of the outer tub to act as splash guard. Protect the wooden parts, the edge of the hole in the inner tub, and other metal parts likely to rust with high-grade spar varnish.

When the washer has been set up, it is necessary to find the correct water level. To do this, the capacity of the small tub must be known. (If not known, measure how much it will hold before cutting the hole in the bottom.) Now measure the distance from the rim of the inner tub to the cover. Transfer this measurement to the outer tub, measuring down from the rim and making a mark. Fill the outer tub with water to this mark and then add two thirds the volume of water the inner tub could hold. Mark the water line thus obtained. This gives approximately the upper level.

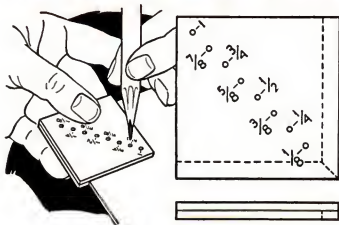
The action of the washer is as follows: The fan sucks the air from the inner tub and raises the water level in the inner tub until the water in the outer tub falls down to the rim of the inner tub. Air then rushes into the



The inner tub assembly. This is one of several experimental washers, all of which proved satisfactory. Note the splash ring under the cover

inner tub and the water regains its original level. It is this agitation of the water and air that washes the clothes. If the motor, by any chance, is not able to produce the necessary turbulence, lower the water level.

Laying Out Margin Lines on Cardboard or Paper

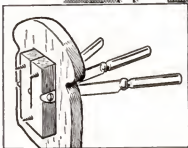


WHEN a number of sheets of cardboard or paper have to be ruled with margin lines, as is often necessary in preparing standard-size drawing sheets, notebook pages, charts, and the like, it is a tedious task to measure each one individually. To speed up the work, a corner marker may be made of heavy cardboard, wood, or metal as shown. Place the marker tightly against the corner, insert a sharp pencil point into the desired hole, and rotate the pencil a little to leave a dot.

Amusing Towel Rack Made from Knives

RESEMBLING a piece of toast with knives stuck into it, this novel dish-towel rack never fails to arouse curiosity. The "toast" is jig-sawed from a piece of pine $\frac{1}{2}$ " by $4\frac{1}{2}$ " by 5", and three slots are cut in the center $\frac{3}{4}$ " apart to receive the knife tips. The whole front surface is then punched to resemble bread and toasted over a flame until the correct color. Sand off the surface lightly to leave light and dark spots.

The three knives are inserted into the slots in the wood so that about $\frac{3}{4}$ " of the tip comes out through the back. Bend the two outside knives so they point at an angle to the right and left; then remove all three and drill holes in the tips. These are for a small bolt, which passes through the knives and through a block of wood cut to fit between the points of the two outer knives and slotted in the center to receive the middle knife. Drill holes in this block and screw it to the wall. Then insert the knives in the "toast," set it in place, and pass the bolt through to hold all securely. The wood may be finished with varnish, white shellac, clear lacquer, or wax.—E. K.



Front and rear views of rack. The "toast" is finished with white shellac, varnish, or wax



Candles Chilled to Prevent Excessive Dripping

CANDLES used with a console set often drip badly after they have been burning only a short time. The next time you expect to light the candles, place them in the refrigerator for a few hours beforehand. They will then burn with much less dripping.—W. S.

Petroleum Jelly Quiets Noisy Electric Clock

INEXPENSIVE electric clocks of the so-called "manual-start type" often develop an annoying humming and thumping sound. This usually can be silenced by applying petroleum jelly to the gears with a match stick. One treatment is likely to last at least a year. If the clock does not start easily when cold, leave the current turned on for about an hour to warm it up slightly.—S. W. J.

Blackboard Chalk Carried in Old Lipstick Case

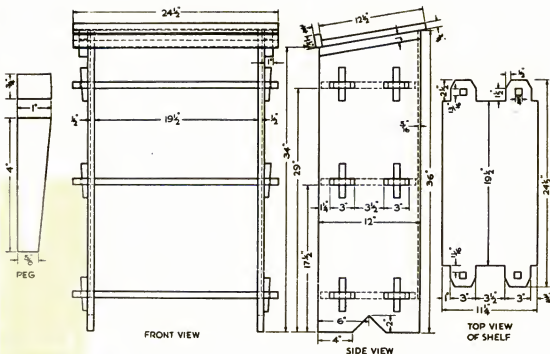
TEACHERS, workmen, checkers, and others who have frequent occasion to use blackboard chalk and make it a practice to carry a stick of it with them, can prevent their pockets from becoming soiled with chalk dust by inserting the chalk in a discarded lipstick case and make it a practice to carry a stick of it with them, can prevent their pockets from becoming soiled with chalk dust by inserting the chalk in a discarded lipstick case of suitable size. As the chalk is used up, it can be pushed forward by pushing the regulator on the side of the case.



As the chalk is used up, it can be pushed forward



Although designed for hard service, this bookstand can be taken apart in a few minutes. The original was finished with several applications of raw linseed oil thinned with turps



Bookstand

BUILT WITH SLANTING TOP FOR DICTIONARY

By
**MILTON
J.
REAMY**

PEGGED mortise-and-tenon joints enable this substantial bookstand to be taken apart for shipment and reassembled in a few minutes. This feature, added to the fact that it holds a large dictionary on top, makes it especially desirable for college students.

Chestnut was selected for the original piece, but oak is even more satisfactory. The holes in the tenons should extend slightly inside the open mortises when the piece is assembled; this allows the shelves and sides to be drawn together tightly by the pegs. Bevel one side of the hole in each tenon to correspond with the peg's bevel. The lower shelf is 4" above the floor.

The ledge is attached to the top with countersunk screws, which are concealed with wooden plugs. Fasten the cleats to the sides, then pass screws through the bottom of the cleats part way into the underside of the top.

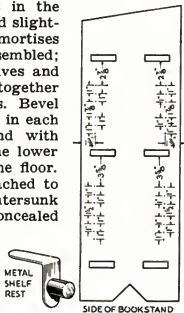
LIST OF MATERIALS

| No. | Pc. Description | T. | W. | L. |
|-----|-------------------------|----|-----|-----|
| 2 | Sides | ¾" | 12 | 36 |
| 1 | Top | ¾" | 12½ | 24½ |
| 1 | Ledge | ¾" | 1½ | 24½ |
| 2 | Cleats | 1 | 1 | 12 |
| 3 | Shelves | ¾" | 11¼ | 24½ |
| 2 | Movable shelves | ¾" | 11¼ | 19½ |
| 12 | Pegs | ¾" | 1 | 4 |
| 1 | Plywood back (optional) | ¾" | 20½ | 32 |

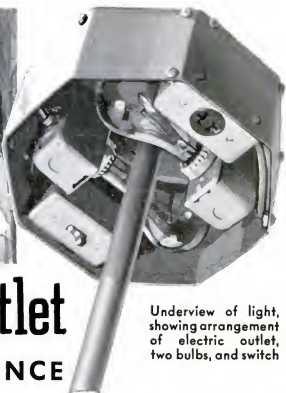
HARDWARE

- 8 metal shelf rests.
- 7—1¼" roundhead iron wood screws with washers for ledge.
- 12—¾" roundhead iron wood screws with washers for back panel.
- 16—1¾" roundhead brass wood screws with washers for cleats.

Note: All dimensions are given in inches and are finished sizes.



Holes are drilled where indicated for metal rests to support the movable shelves



Underview of light, showing arrangement of electric outlet, two bulbs, and switch

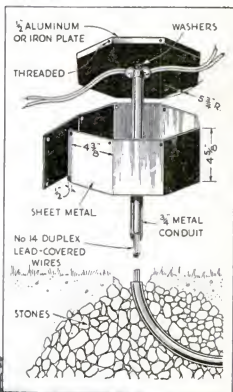
Yard Light with Outlet

IS YEAR-ROUND CONVENIENCE

MOTORISTS will find this yard light a year-round convenience for both outdoor-lighting and car-servicing needs. Its unobtrusive indirect illumination creates a pleasant atmosphere for lawn parties and similar outdoor after-dark entertainment. It has a convenience outlet into which toasters, coffee urns, battery chargers, trouble lamps, and other electrical appliances can be plugged. Wired for two-point control, the light can be switched on and off from both inside and outside the house. A pilot light, located at the switch in the house, may be connected in the circuit.

All-metal construction makes the fixture weatherproof and shatterproof. The $\frac{3}{4}$ " metal conduit that brings the wires up from underground also serves as the standard of the fixture. To give it a firm footing, rocks or crushed stone should be tamped into the ground around the base. The height of the fixture is determined by the area desired to be lighted. It should not be so high that direct rays from the lamps strike the eye, yet it should stand high enough to clear normally high snow-drifts.

The end of the conduit is threaded to take a pipe flange, to which the canopy is screwed. For this purpose, four screw holes must be drilled in the canopy top and threaded. Wires from the conduit enter the canopy through the clearance between flange and canopy top, provided by bushing the screws with washers. The seam, where skirt and top join, should be made water-tight by caulking with oakum. If the screws binding the pieces together are first loosened slightly, twisted threads of oakum can be laid in the seam and the screws then tightened to seal the joint. Lamp receptacles, switch, and convenience outlet are mounted in



The indirect illumination produces a pleasing effect for after-dark parties

TURNED WOODEN ARM SUPPORTS

Swinging Bed Lamp

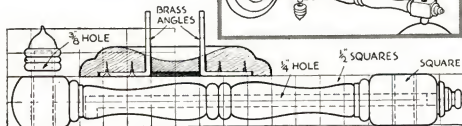
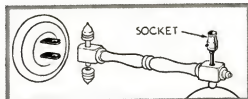
AN ATTRACTIVE swinging bed lamp may be made from an ordinary small table lamp. The socket in the lamp is held by means of a short piece of $\frac{1}{8}$ " pipe, and it is a simple matter to substitute a longer piece of pipe, thus giving room to clamp the outer end of the swinging arm between the socket and the body of the lamp.

The swinging arm and wall bracket are turned from hard maple, walnut, mahogany, or other suitable wood. The dimensions indicated are suitable for a lamp having a body about 4" in diameter and fitted with a shade 8 $\frac{1}{2}$ " across the bottom. The pivot arrangement is made by bending two pieces of brass about $\frac{1}{8}$ " by 1" by 2 $\frac{1}{2}$ " at right angles in the center. A $\frac{13}{32}$ " hole,



to accommodate $\frac{1}{8}$ " pipe, is drilled in the outer leg of each angle, and a hole is drilled and countersunk in the inner leg of each of the angles so they may be fastened to the wall bracket with small flathead screws. A piece of fully threaded $\frac{1}{8}$ " pipe, cut to the proper length, acts as a hinge pin. When the acorns are screwed into place, the pivot arrangement is complete. The $\frac{3}{8}$ " hole in the acorns should be tapped for $\frac{1}{8}$ " pipe. If no tap is available, cut a slot in the end of an ordinary piece of threaded pipe, and this will serve for cutting the threads in the wood.—HENRY E. BELDEN.

The dimensions of the arm are for a shade that has a diameter of about 8 $\frac{1}{2}$ "



Long Clips Keep Music from Blowing Away

IN PLACE of regular music pins or clips, I use long wooden clips, resembling elongated spring clothespins, to keep orchestra music from blowing away when playing outdoors in a breeze. These were made by taking the springs from ordinary wooden clothespins and shaping new, extra long jaws from hardwood.—A. N. WARNER.

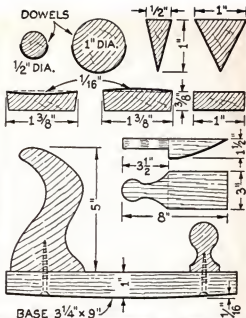


The clip and how it clamps the music

Solder and Wire Fasten Deadeyes

AN EASY way to fix the lower deadeyes on a ship model is to bend copper wire around each deadeye as shown in the accompanying sketch and then flow solder between the two parallel ends. Wire about $\frac{1}{32}$ " in diameter is usually suitable. The chain plates and backing links may be cut from sheet copper or brass, drilled and bent.—S.R.





The drawings show seven sanding-stick shapes and two hand sanders; the photos illustrate how they are used

Homemade Tools Aid in Sanding

SANDING tools of the type illustrated above help the amateur craftsman in obtaining a better and smoother finish on his furniture and other woodworking projects, particularly those jobs which have awkward corners or curves. The sanding sticks, all of which may conveniently be made 14" long, are covered where indicated by the heavy lines with 9" long strips of medium grade sandpaper. These strips are fastened with quick-setting cement $1\frac{1}{2}$ " from the tip, so as to leave a $3\frac{1}{2}$ " long handle. Well-seasoned pine is satisfactory for the sticks, which are invaluable for smoothing

hard-to-reach places in curved or irregular work.

For flat surfaces, the two hand sanders shown will be found useful. One is especially designed for working close to the edges of panels. Note that the faces of these two sanders to which the sandpaper is applied are very slightly curved. There is a crown of approximately $1/16$ ". If these tools are frequently tapped on the workbench while in use, it will keep them from becoming clogged and will help to prolong the life of the sandpaper considerably.—FRANK HEGEMEYER.

Files Cleaned by Using a Wire Suède Brush

ALTHOUGH files should be kept clean, a regular file-cleaning brush is not always available. An excellent substitute, which can usually be purchased for ten cents at department stores or ten-cent stores, is what is known as a "suède brush." This has stiff wire bristles, and a few strokes with it will clean the accumulations from any hand file.—K. L. R.





new SHOP IDEAS

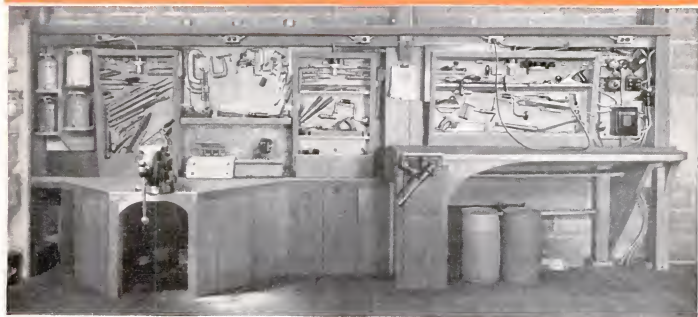


The tool-cabinet covers slide behind the bench. Below, the left half of the shop is for metal work; the right for woodwork

ULTRAMODERN Workbench AND Tool Cabinets GIVE INCREASED EFFICIENCY

By J. MODROCH

TO BE able to work with convenience and clean up with pleasure was the long-felt desire that prompted the building of this improved shop outfit. Shop space available and the layout of tools on hand were the factors that determined the dimensions and proportions of the various members of the unit. The set-up covers a





Clamping work between the vise and a solid backing of "four by fours." Right, view showing end of cabinets and angle brace under the bench top



floor area approximately 2' 9" by 15' and extends up the wall 5' 6½". However, without necessarily impairing the functional design of the unit, the parts may be considerably altered in both size and proportions to suit individual requirements.

The design of the two-level bench is based on the need for mounting both a woodworking vise and a large metal-working vise at a convenient working height. Accordingly, the upper level is built to the usual height of 2' 10" to permit the flush mounting of a woodworking vise, while the lower level, dropped to a height of 2' 1", allows a 5" metal-working vise to be bolted on its surface.

Solid-front construction gives the metal-working bench a sturdiness that allows for heavy pounding and also serves as an aid to maintaining cleanliness by preventing shavings that fall from the woodworking vise from drifting underneath the bench. For these reasons this solid-front construction is extended into the upper level to a point just beyond the woodworking vise.

The irregular shape of the lower-level bench top permits working with ease from positions behind the vises. And by supporting the free end of the upper level with a heavy wooden angle brace, instead of a leg, as shown in the end-view photograph, the space beneath the bench is made accessible for storage of mill lengths of lumber, pipe, and other long materials.

An assembly of 4" by 4" uprights secured on the wall opposite the woodworking vise provides the solid backing necessary for surface-planing boards and clamping up gluing jobs. The eye-level storage shelf is built sturdily enough to hold heavy loads without sagging, while it also serves as a firm support for the wiring and plug-in boxes. This shelf is kept reasonably narrow to prevent its becom-

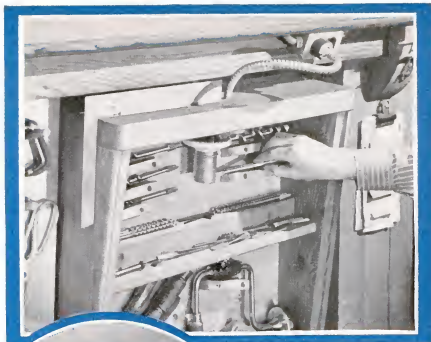


Cabinet shelves tilt backwards slightly and are designed to suit the tools. Bulkier tools are stored at top. Note rabbit for plywood cover

ing cluttered with inaccessible parts and materials.

The tool cabinets are individually mounted directly on the wall in order to allow for changes in the layout should additional cabinets be added to house new tools. Tapering from an inside depth of 6" at the top, where bulky tools such as breast drills are shelved, down to a depth of 2" at the bottom, where thin tools such as saws and hammers are kept, the cabinets overhang the bench with a minimum amount of interference with bench work. Moreover, their tapering shape readily lends itself to the convenient arrangement shown in the drawing whereby the plywood covers can be lifted out of the cabinet fronts and lowered out of the way behind the bench.

The cabinet shelves are tailored to the tools, holding



Shaded electric lamps of low wattage heat the cabinet to prevent the tools from becoming rusty in damp weather



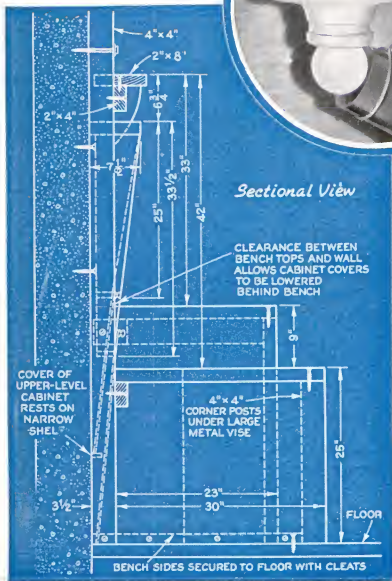
them in the best possible positions for being picked up and replaced with ease. The principle involved simply calls for tilting the shelves slightly backward, and also to one side if necessary, so as to prevent the tools from slipping

off or shifting out of place.

As an aid to maintaining neatness in the cabinets, shelves allotted to miscellaneous small tools should be built narrow. This will discourage the tendency to lay large tools temporarily on top of small ones. Locks, instead of catches, may be installed to secure the cabinet covers in place, if desired.

Drilling Overlapping Holes

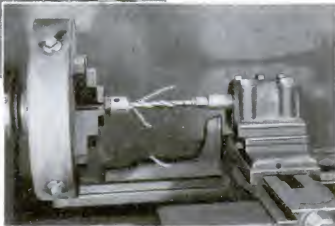
WHEN a hole has to be drilled with a twist drill in metal or other material where it overlaps another hole or the edge of some opening, the point of the drill nearly always slips off into the other hole or opening, sometimes spoiling the work completely. This may be avoided if the center of the new hole is marked with a prickpunch and first drilled with a very small drill. This small hole then serves as a guide for the larger drill and keeps it from running off.—HOWARD A. BOWMAN.



Rigid Boring-Bar Holder Fastens on Cross Slide



The holder is not only excellent for boring as shown above but also for drilling as at the right, or for reaming, if a suitable sleeve is turned to fit the hole



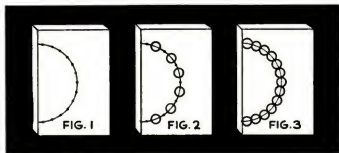
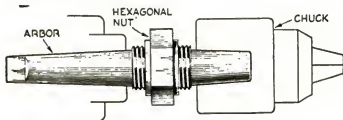
The original pattern and the completed holder and hold-down strap

HERE is an inexpensive cast-iron boring-bar holder that is much more rigid and more easily mounted than the ordinary tool-post type bar holder. The upper part of the pattern is carved from a single piece, and glued or nailed to the flat base. When machining the holder, face off the base first; then mount the holder on the faceplate to drill the holes for the hold-down bolts, so the two holes will be parallel. The hold-down strap should just about fill the T-slot in the cross slide. Mount the holder on the cross slide to drill and ream the hole for the bar. This hole should be as close as possible to the hold-down bolt holes without breaking through to them. The closing kerf is cut with a hack saw. The last operation is to drill and tap the three clamping bolt holes as indicated.

—ROBERT B. DOUGLAS.

Modified Drill-Chuck Arbor Makes Removal Easy

THE arbor of a drill chuck is frequently somewhat difficult to remove from the chuck or from the lathe headstock sleeve without damage to the parts. A good plan is to make a new arbor and chase about an inch of threads between the two tapers. The smallest diameter of the thread should be slightly larger than the tapers. Turn shoulders on a nut, as shown below, and thread to fit the arbor. To remove either chuck or sleeve, simply screw the nut against their faces and they will be crowded off the arbor without injury.—H. E. RISLEY.



Drilling Series of Holes

WHEN it is necessary to cut large holes or irregular shapes in thick steel or cast iron by using a drill, a good many mechanics will start drilling at one end and continue right along from one hole to the next. The first thing that happens is that the drill runs off into the previous hole. This leaves much solid stock and results in the breakage of drills and a generally rough job. The proper method is to lay out and center-punch the holes accurately and drill every other hole, then go back and drill the rest of them. The drill then has no chance to run off.—DAN MARVOSH.



Using the indicator to center a punch mark in an irregularly shaped casting prior to boring

Wiggling Indicator

FOR CENTERING
IRREGULAR WORK
IN THE LATHE



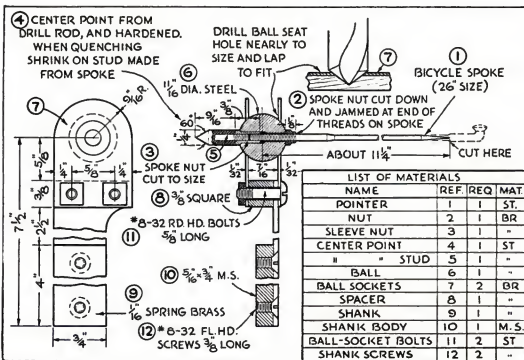
AMATEUR machinists will find the construction of this center indicator or "wiggler" an interesting problem. The heart of the tool is a steel ball about $11/16$ " in diameter from a ball bearing. It should be heated a bright red and cooled slowly to soften it. Chuck it in a three-jaw chuck and drill through a clearance hole for the threaded end of a bicycle spoke; then drill halfway through a clearance hole for a standard bicycle-spoke nut. The hook end of the spoke is cut off and the end pointed.

A $1/8$ " portion of a spoke nut (2) is jammed at the end of the threads. Another nut (3) is cut to $3/8$ " in length and serves as a sleeve nut to hold the pointer in the steel ball (6).

The center point is turned from high-carbon drill rod and hardened, being previously drilled for a very tight fit on a stud (5) made from another spoke. The stud is dropped in the center point when it is heated for hardening so that, when

quenched, the point will be shrunk in place.

Note that the holes for the bolts (11) should have considerable clearance so that the ball-socket plates (7) may be moved around slightly. The ball seats should be lapped to fit with valve-grinding compound. It is not necessary to reharden the ball. An essential feature is the spring-brass shank (9), which provides the spring action so that the center point may be kept firmly seated in the punch mark in the work to be centered.—DONALD A. PRICE.



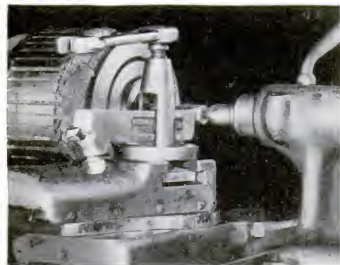
Band-Saw Blade Support Adjusted by Using a Scale

A HEIGHT scale made from a broken folding rule may be attached to a band saw as shown for adjusting the upper blade support so that it just clears the work. It may be necessary to insert a small wooden block behind the scale to provide clearance. The scale slides up and down with the blade support. A pointer made by sharpening and bending a long $\frac{1}{4}$ " carriage bolt is fastened to the frame of the band saw.—H. R. H.

A Quick Way to True Up Damaged Center Holes

OFTEN when an armature or other shaft is placed in the lathe, it is found that one of the center holes has been damaged or for some reason is out of true. Instead of setting up the steady rest to true it up as is customary, a quicker method is to use a little tool that can be made in a few minutes. Find a short, broken, or worn-out drill (preferably high-speed) that will fit the tailstock, and grind it into a cutting center, flat on four sides with the cutting edges forming the regular 60-deg. angle.

The tool is set up in the tailstock in place of the regular center, and the armature is put in with the defective end on this cutter. Turn the tool holder around in the tool post and run the carriage in until the blunt end of the tool holder is against the shaft as near to the end as possible. Now start up the lathe and simultaneously feed in the cutter and push against the shaft by feeding in the carriage. This will cause the cutter to cut with an action more like that of a boring tool than a drill. Cut it carefully for a few seconds, then put in the regular center.—JOHN COOK, JR.



A sharp, four-sided cutter trues the center hole while the reversed tool holder steadies the shaft



The scale slides with the blade support, and the height is read by means of a pointer on the frame

Padded Tailstock Crank

WHEN the tailstock is used for drilling operations on the lathe, one's fingers often become tired from turning the crank handle, but a sponge-rubber ball in which a hole has been drilled may be slipped over the handle as shown to form a large, soft surface that is easy to grip. In withdrawing the drill, the ball may be tapped smartly with the fingers, which will cause the handle to spin quickly.



Paintbrush Removes Excess Solder

A CLEANER job of soldering can often be done if the excess solder which oozes out of the joint is brushed off with a cheap paintbrush while still molten.—H. S. THOENEKE.

Small Telephone Stand and Chair Fit into an Unused Corner

THE telephone stand and chair illustrated are offered as a suggestion to woodworkers who like to exercise a little originality in designing the furniture they build. In this case the turnings, the back of the chair, and other elements of the design may be worked out by the builder to suit himself.

The quarter-round table top has a radius of 18", and the sides are 18" long. The legs are 25" long, and the directory shelf is 3" deep. The front legs of the chair are 18" long, the back legs 30". The removable seat, which is 12" square, is covered with imitation white leather. In this case all the turned parts were made of straight-grained maple, and the remainder from walnut lumber a full $\frac{3}{8}$ " thick when finished.

It is desirable to insert a small screw eye in the back of the rear leg and another screw eye

in the baseboard of the room so that the two can be joined with a short piece of stiff wire. This will prevent any tendency of the table to tip forward if someone presses down heavily on the telephone while it is resting near the front edge of the table. The wire can be readily unfastened when it is necessary to move the table.—

HERBERT WOODLING.



The table is shaped so that it will go in a corner, and the chair is pushed under it when not required

An Imitation Bronze for Model Work

FOR model work, one of the best imitation bronze effects I have seen is obtained by mixing gold bronze powder in black paint.—ANTONIO GELINEAU.

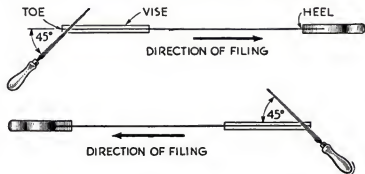
FILING A CROSSCUT SAW

[WOODWORKING]

1. Joint the saw very lightly as an aid in filing. 2. Clamp it in a saw vise with the handle to the right. 3. Start in the gullet to the right of the first tooth that is pointing away from you. Hold

the file horizontally and at an angle of from 45 to 55 deg. to the blade. With the file in this position, file every second gullet until the handle is reached. 4.

Now place the saw in the vise with the handle to the left and file the gullets skipped the first time, beginning at the toe. This method has the advantage of leaving a smaller burr on the front edges of the teeth, but saws may also be filed from the heel to the toe.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

Celluloid Silhouettes

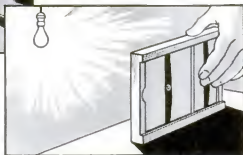
MADE PHOTOGRAPHICALLY



An easy way to take a good silhouette portrait is to pose the subject before a window or a sheet brightly illuminated from behind with a photoflood lamp



Painting in the shoulder line. A print is then made on process film, as shown below



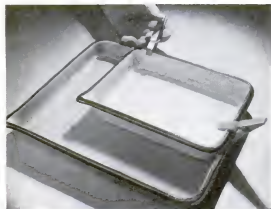
The positive film, which is transparent except for the silhouette, is mounted on colored celluloid

BY A SIMPLE photographic method, it is easy to make celluloid portrait silhouettes. The first step is to take a profile-view photo of the subject in front of a window or a sheet brightly illuminated from behind. Endeavor to get as nearly a black-and-white picture as possible.

After the negative is developed, the shoulders of the sitter may be blocked out to the shoulder line, if desired, with deep red photo water colors or any opaque water color or poster paint. The negative is now printed, not on paper, but on a piece of so-called "process" film. This is done in a printing frame as if a paper print were being made, except that the exposure must be very brief. It is usually sufficient to stand about ten feet from a 40-watt bulb and flash the light on for a second.

When developed in the usual way, this positive film should show a solid black silhouette against a background of perfectly clear celluloid. This may now be cemented on a piece of sheet celluloid of any desired color by using acetone as a cement and applying pressure.

Another method of preparing the silhouette is to make a print on paper, cut out the head accurately, moisten it in water, and press it on a piece of black or colored sheet celluloid. Mark around the outline with a very sharp scratch awl, scribe, or phonograph needle mounted in a pin vise or suitable handle. Remove the print by slipping a thin knife blade under it, cut out the celluloid, and mount it on a second piece of celluloid having a contrasting color.—E. E. YOUNGKIN.



Cooling Developer in a Tray

WHEN tray development is used, a common method of keeping the developer cool in hot weather is to place the tray in another larger tray in which cold water circulates. A good way to prevent the smaller tray from floating about or tipping, is to clip the trays together on two sides by means of spring clothespins.

Clothespins of this type, incidentally, are a valuable accessory to the darkroom. They can be strung on a wire or cord for holding films while drying or used as clips to hold the ends of narrow roll film during tray development.—O. B.

Darkroom Ventilated

WITH A SMALL VACUUM CLEANER

VENTILATION for the darkroom can be provided by means of an electric hand vacuum cleaner such as is used in cleaning upholstered furniture. A slot should be cut in the wall of the darkroom to receive the mouth of the cleaner. A gasket of felt or heavy flannel is cut to extend over both sides and glued in place; then an opening is cut in it to match the outline of the hole. Attach a piece of wood, cut as shown, so that the cleaner may be hung in position and add a strip of tin to extend up far enough to engage the edge of the nozzle and hold the cleaner.

In operation, the bag should be removed from the cleaner. When the cleaner is needed for cleaning purposes, a block of wood is fitted into the bracket to shut out the light.—B. N.



The mouth of the cleaner fits tightly against a slot in the darkroom wall



When the cleaner is removed, the slot is closed with a block of wood

HYPO TESTER

When a hypo bath has been used for some time and it is desired to test it to see whether it is still serviceable for fixing prints, place $\frac{1}{2}$ oz. in a measuring glass and add four drops of a 20 percent solution of potassium iodide. If a precipitate forms, the hypo is no longer any good. A sufficient quantity of this tester for several hundred tests may be made by adding 80 grains of potassium iodide to 400 minims of water.

[PHOTOGRAPHY]



POPULAR SCIENCE MONTHLY SHOP DATA FILE

DOUBLE-JET

Print Washer

SAVES TIME AND WATER



The prints are washed quickly by a whirling motion, and the hypo-laden water is drained from the bottom

AN EFFICIENT washer for photographic prints may be made as shown from a small galvanized-iron tub about 7" deep and 16" in diameter. If a suitable tub cannot readily be obtained, it is possible to have it made by a local tinner.

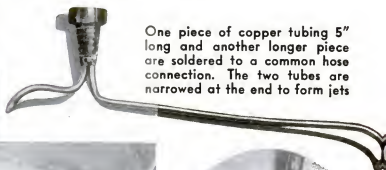
On one side, near the bottom of the tub, seven or eight small holes are punched. Outside this section of the tub a drainage compartment or apron 5" deep is soldered on, and this has an overflow spout in the center near the top.

For the water jets, two pieces of copper tubing are soldered into an ordinary hose connection, and this screws on the faucet. Slots are cut in the end of each tube, the points are bent together, a small nail is inserted, and the cuts are then soldered so that when the nail is removed there will be a small opening that will throw a forceful jet of water. The tubes are bent to throw the water in opposite directions, which causes a continuous whirling motion of the prints. The short one is also bent to throw the water down toward the drainage holes in order to prevent the prints from collecting there and preventing the water from escaping.

A separate faucet may usually be provided for the washer by connecting an ordinary faucet with threaded spout to a short length of pipe and inserting a pipe tee back of the regular sink faucet into which the pipe can be screwed.—BENJAMIN NIELSEN.



The drain holes are at the bottom. From them, the water flows into a drainage apron and out through the overflow spout at top



One piece of copper tubing 5" long and another longer piece are soldered to a common hose connection. The two tubes are narrowed at the end to form jets



How to Hold Roll Film in a Tray for Fixing

THOSE amateur photographers who make a practice of fixing roll films in a tray can hold them submerged in the hypo by means of two spring clothespins as shown. Simply fold the strip of film twice and clip the ends to the edges of the tray. The same method is suitable for washing the film when a deep tank is not available.—G. S. G.



The strip of film is folded twice, and the ends are clipped to the tray with spring wooden clothespins

Dissolving Developers Properly

Two precautions are important when preparing developing solutions. Do not use water hotter than 125 deg. F., and also be sure that one chemical has been dissolved completely before a second chemical is added.



Visual Exposure Meter Aids in Printing

AN EXPOSURE meter of the visual extinction type can be used to determine the average density of a negative as an aid in deciding how long an exposure to give it in either contact printing or enlarging.

The negative is held about 6" in front of a 40-watt electric lamp and moved back and forth while being viewed with the meter. The last numeral visible in the meter is the exposure factor. Each numeral indicates a certain length of exposure, and a change of about three numerals also calls for the use of paper of the next grade. These factors are best determined by the actual experimental printing of small strips of paper, the results being kept for reference.—M. G. WINTERTON.

FILMS—GENERAL CHARACTERISTICS

[PHOTOGRAPHY]

Ordinary. Sensitive only to blue, violet, and ultra-violet light. Examples: Kodak uncurling roll film, which is of snapshot speed, and process film, which is used in copy work where color rendition is of little importance. Process film is capable of great contrast, but is of slow speed. Filters are not used with ordinary films.

Orthochromatic. Has increased sensitivity, which includes the yellow-greens but not red. Examples: Verichrome, Plenachrome, etc. Red filters cannot be used with these films.

Panchromatic. Sensitive to the entire visible spectrum, including red. These films are made in many special forms, but generally fall into one of the following groups: 1. Ordinary panchromatic, such as commercial pan and process pan films. 2. Orthopanchromatic with color sensitivity corresponding closely to that of the eye. Portrait pan films generally fall in this group. 3. Hyperpanchromatic, with extreme sensitivity to yellow, orange, and red, such as films with the prefixes "superpan" and "hyperpan." All pan films lend themselves well to the use of filters.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

RALPH G. WARING GIVES THE ANSWERS to Some

USING SHELLAC ON FLOORS



We have shellacked our new floors, but they scratch easily in white lines and have no endurance at all near the doorways. What is wrong here?

You probably were sold a shellac substitute. Shellacs, both white and orange, should be bought on the basis of a four-pound cut (4 lb. of gum in 1 gal. alcohol) and the label should guarantee pure shellac. Thin the shellac with an equal volume of denatured alcohol and apply by brushing as little as possible. It is an improvement to add an equal amount of so-called "shellac-mixing lacquer" to the reduced shellac, but do not mix more than can be used up.

If a floor has been waxed previously, the old wax must be removed by a thorough scrubbing with a trisodium-phosphate washing powder and dried overnight. Sanding with No. 0 paper may also be necessary, in which case wipe the floor with a slightly damp rag before shellacking. Following the use of one or two thin coats of shellac, the floor may be waxed and polished with a weighted polisher once or twice a month.

ENERGETIC and skillful use of the paintbrush does more to keep a house looking shipshape than anything else. Amateur painters, however, encounter problems from time to time that puzzle them a good deal, such as those described in the accompanying questions and answers.

SCREENS CAUSE STREAKS

Dark brown or black streaks are appearing on my newly painted house wherever there is a copper screen. What is the cause and remedy for this?

Traces of copper are dissolved from the wire screening during rains and are carried down over the painted surface by the water. If there is zinc or lithopone in the paint

composition, the materials will react to form a permanent discoloration. This is not true of lead-and-oil paints. (In choosing a house paint, this is a minor consideration, and it must be understood that the zinc-and-lead type is an excellent paint.) Wash the copper mesh with denatured alcohol and a scrub brush; then as soon as it has dried, give a thin coat of outside spar varnish, well brushed out. This process will have to be repeated yearly.

BLISTERED PORCH COLUMNS

Two large wooden columns supporting the porch roof are badly blistered, and this has happened repeatedly, even when the paint has been burnt off.

The columns should be ventilated by boring several holes $\frac{1}{2}$ " in diameter at

HOW TO ENAMEL OVER METAL

I have a set of child's bedroom furniture in enamel over steel tubing. The finish is chipping badly and needs to be renewed. How should this be done?

Your metal furniture was evidently "price goods" on which the metal-primer first coat was omitted, or the metal had not been properly cleaned. Scrape off the old paint as far as possible with steel scrapers; finish with varnish remover and then with steel wool and alcohol to insure removal of all traces of paint remover. Do not neglect this step. Next apply a well-brushed-out coat of metal primer, as made for auto refinishing work, according to the directions on the can. After this has dried hard, brush on a coat of four-hour enamel of the desired color. Dry hard and rub off the gloss with No. 0 steel wool. Clean and dust carefully to remove every trace of the steel wool, then brush on the final coat of enamel. Dry one week in a warm room before using to insure a tough, hard finish.



Puzzling Paint QUESTIONS

the base and just under the cap. Bend small pieces of screen wire into the shape of thimbles over the end of a stick and insert them in the holes to keep insects out. Push them in, open end first, so the smooth cap of screening will be flush with the surface. If lightly painted, the wire will also render the holes almost unnoticeable.

AVOID SUBSTITUTE TURPS

I have been told that ordinary oleum spirits, which may be obtained for as little as fifteen or twenty cents a gallon, are excellent for thinning paints.

Never use turpentine substitutes. They are a small fraction distilling between low-grade gas and kerosene, and often have enough traces of light paraffin oil to cause trouble.

SEALER COAT OVER STAIN

Why do you recommend the use of a sealer coat over the stain before filling a floor with a silix filler?

Where a high-grade stain has been used to color a modern floor, the use of filler without a sealer would tend to obscure the beauty of the stain. Then, too, the oil in the filler would be certain to sink into the pore areas and thereby produce a darkening effect and possible shrinkage of the filler due to loss of the binder. When the floor or other woodwork is properly sealed with varnish reduced from one half to two thirds with pure turpentine, this sealer coat sinks in solidly; prevents the filler from obscuring the stain, enables it to be wiped off the surface more readily, and keeps it from shrinking in the pores.

Shellacs, regardless of how much they are reduced, do not make durable sealer coats on floors finished in varnish, even though a number of painters use this method simply because it is quicker.



REFINISHING CEMENT FLOOR

Varnish on the red cement floor of our recreation room has become soft and sticky in places, following a flood. What can I do?



Dissolve 1 lb. sal soda in a 10-qt. pail of hot water. Apply this to a square yard of floor with a broom and let soak. Repeat on a second and a third square yard. Go back to the first area and scrub the varnish loose with the broom, or you can use a painter's wire brush if your hands are protected with vaseline or rubber gloves. Completely remove all traces of finish and mop clean. Repeat with second and third areas and continue in this way until floor is all stripped. Mop up with plenty of clean water. Next dissolve 2 lb. zinc sulphate in 1 gal. water and apply in this ratio to the entire floor as soon as possible after stripping with sal soda. Let dry very thoroughly.

Brush the floor clean, then varnish one coat. Dry hard for at least three days, then varnish a second coat, which should be dried for one week, with heat in the room as near 70 deg. F. as possible, before using.

PAINTING FLOOR OF PORCH

I am installing an upstairs sleeping porch and using comb-grained fir flooring. How should this be laid and finished?

If the floor is at all exposed to driving rain, the joints of each strip of flooring should be heavily painted with floor paint and then driven up tight and nailed. Wipe the face of each joint clean of excess paint when nailed. The floor should then be primed with a well-brushed-out coat of standard deck paint. Reduce the priming coat with an equal quantity of pure turpentine and let dry hard; this is very important. Then brush on a full-bodied coat of well-stirred deck paint. For best results, sand with No. 00 paper between coats, being careful to wipe up the dust.

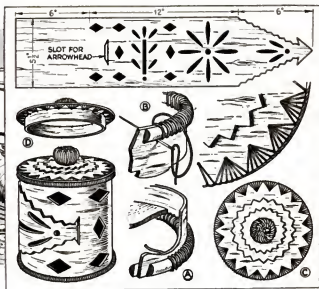
A Birch-Bark Utility Box of Chippewa Design

CONSTRUCTED

from birch bark, this little Chippewa box may be used as a container for a large round can of tobacco, scouring powder, or the like. It will also serve by itself as a box for handkerchiefs and various odds and ends. In case birch bark is not readily obtainable, parchment may be used as a substitute. Dimensions, of course, will depend

upon the use to which it is to be put. Those indicated on the drawings are suitable for a handkerchief box. If it is to hold tobacco, make it to fit around the can in use.

The designs are formed by cutting holes in the material and backing them with red or green cloth. To finish off the bottom, a thin reed is split and the two pieces are sewed with yarn to the edge, one inside and the other outside, as shown at A. The top is finished similarly except that only one piece of split reed is sewed around the outer edge as at B. The bottom is stiff cardboard or thin



wood, glued in place against the yarn-covered reed.

The cover consists of three pieces, progressively smaller in diameter, as at C. The two smaller ones are notched around the edges. The second one is sewn in place where the stitches will be concealed by the third piece, and the latter is held with a tassel of yarn of the same color as the cloth lining. A stitched design is added, and a strip about 1" wide is sewed on the underside of the cover near the edge to form a sort of flange that will fit into the box as at D.—GRAY WOLF.

Tin Can Fastened on Wall to Hold Extension Cord



The can is fastened at an angle by means of a wooden wedge

INSURANCE underwriters say that an electric cord should never be hung from a nail, yet if the cord is coiled and put on a shelf or in a box, it is likely to become tangled. A tin can fastened to the wall at a slight angle makes a good cord holder because it is smooth and large enough not to injure the cord. A stove bolt holds the can on a wedge-shaped block of wood that is nailed to the wall. The block and can may be painted to

match the woodwork. The space inside the can will hold a spare electric bulb or a double socket.—JOHN M. AVERY.



Tape on Thumb Tacks Aids in Pulling Them Out

EASILY removable thumb tacks may be made by pushing each tack through the center of a short piece of adhesive tape. The ends of the tape are then brought over the head of the tack and stuck together. Round the ends to make a neater looking job. The flexible tabs can be flattened against the board, thus offering no obstruction to the T-square, but are readily gripped to pull out the tacks.—HENRY and RICHARD HANSCOM.



Secretary Harry Spock, right, of the Peekskill club receives the plaque shown below from Arthur Wakeling, a Guild director

Guild Bestows National Honors

ON HOME WORKSHOP CLUBS

ONE day last November a little girl marched into a movie theater in Buffalo, N. Y., and handed a battered doll to the attendant. "Here's my ticket," she said. The paint on the doll's face was chipped and part of its hair was missing, but the man solemnly accepted the toy and let the child enter. More than 1,000 toys of all descriptions, most of them badly in need of repair, were presented as the price of admission that afternoon. A week later a similar scene took place in another theater on the opposite side of the city.

The thousands of toys were removed to nearby vacant stores to be sorted. Some were discarded or temporarily stored because of the amount of work required to recondition them. Trucks carted the rest away to the home workshops of ten local men, the members of the Bison Homeworkshop Guild. During the few weeks remaining before Christmas, the men spent all their spare time feverishly working in their shops to repair as many toys as possible.

Finally Christmas Eve arrived. The names of underprivileged children had been obtained from schools and various agencies. Letters addressed to Santa Claus had been turned over to the club by the postmaster and



AWARDS IN NATIONAL ACHIEVEMENT CONTEST

FOR CIVIC ACTIVITIES

Bison Homeworkshop Guild, Buffalo, N. Y.

FOR CRAFTSMANSHIP

Long Beach (Calif.) Homecraftsman's Club

FOR BEST CLUB PROGRAMS

Peekskill (N. Y.) Homeworkshop Club

HONORABLE MENTION

CIVIC ACTIVITIES—Long Beach (Calif.) Homecraftsman's Club, Busy Bee Homeworkshop Club, Cornwall, Ont., Canada. CRAFTSMANSHIP—Chicago (Ill.) Premier Homeworkshop Club, Nutley (N. J.) Homeworkshop Guild, United States Trust Company Homeworkshop Club, New York City



Children in Buffalo, N. Y., saw a movie by presenting old toys. A. W. Harding, above, and nine other members of a local club repaired the toys and gave them to the poor

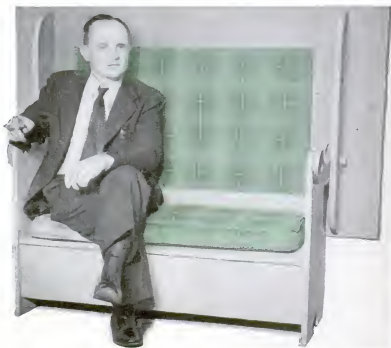
investigated. Everything was in readiness. The men piled the toys into trucks and were on their way. You couldn't have paid them to stay home and let some charitable organization distribute the toys they had spent so many hours in repairing. Their reward was seeing the grateful faces of poor children. Secretary Herman W. Lorenz said, "In several instances mothers told us that they expected no toys from any source, and sometimes tears of thanks filled their eyes as words failed them." The men visited 383 families that day and made 1,350 children happy.

In recognition of the tremendous amount of work this handful of men accomplished in so short a time, the Bison Homeworkshop Guild has been accorded national honors in the form of a beautiful silver plaque for the most outstanding civic activity performed by an affiliate of the National Homeworkshop Guild in the annual achievement contest (see P.S.M., Nov. '38, p. 195). The splendid cooperation of theater managers, newspapers, a bakery that donated a box of cookies for each child, and local firms that loaned trucks is testimony to the high regard with which the club is held in its city.

A carved case for a large grandfather clock made in three months' spare time

by Arnold F. Tuttle won the craftsmanship plaque for the Long Beach (Calif.) Home-craftsman's Club. Mr. Tuttle received a special silver craftwork medal, suitably engraved.

The award for the best club programs arranged during the contest period (October 1,



Henry Buntschuh with his Colonial hutch table, which won second prize in the Wood-Ridge (N.J.) club exhibit

1938, to April 1, 1939) was given to the Peekskill (N. Y.) Homeworkshop Club. The members enjoyed talks and demonstrations on abrasives, polishing steer horns, veneer paneling and inlaying, gluing, workshop problems, soldering, and engraving. In addition, the club visited a glider plant, held a dinner to commemorate the Guild's and its own fifth birthdays, and conducted an exhibition.

Many clubs ended the spring season with exhibitions in windows, in hardware stores, in vacant stores, and as part of local hobby shows. One of the most successful was the fourth annual exhibit of the *Wood-Ridge (N. J.) Homeworkshop Club* which 500 persons attended and cast their votes for what they liked best. The results of the poll follow: first, sewing-machine console made by Henry Hagemann; second, Colonial hutch table, Henry Buntschuh; third, four kitchen chairs, George N. Schalk; fourth, train display, H. W. Krypendorf. The award for the year's most comprehensive and craftsmanlike work, decided by a vote of the members, went to Mr. Schalk, who now has two legs on the club's craftsmanship plaque. He has to win it only once more to retain permanent possession. Mr. Schalk displayed a beautiful pistol display case carved from solid walnut and having an inlaid top.

The North Branch Craft Club of *Montreal, P.Q., Canada*, recently promoted a hobby show. Approximately 350 children and adults exhibited, and more than 1,100 persons attended. Two members demonstrated the de-

sign and modeling of plaques, which were presented later to exhibitors.

Following the first exhibition of the *Vicksburg (Miss.) Homeworkshop Club*, the members spent an entire evening in the workshop of L. L. Gibson, discussing ways of improving next year's display. The next session was held at the home of Sam Albrecht where a baseball bat was made and its practicability discussed as a Christmas toy project.

The Sea Gull Homeworkshop Club, *Atlantic City, N. J.*, is conducting a membership drive. A club workshop has been established and machinery installed. . . Thomas Monteleone demonstrated *repoussé* designing in his workshop for the *Peekskill (N. Y.) Homeworkshop Club*. . . The *Nutley (N. J.) Homeworkshop Guild* plans to sponsor a card party or social to raise money for the purchase of equipment. . . When the Tri-City Homeworkshop Club met at the home of Joseph Seville, *Spring Valley, Ill.*, he demonstrated how to

Grandfatherclock made by Arnold F. Tuttle of Long Beach, Calif., winner of Guild craftwork award. The clock was built in three months. It is 98" high, 16" deep, and 30" wide at the base



Robert Geoghegan of New York City built this locomotive entirely of cardboard



One corner of the fourth annual exhibit of the Wood-Ridge Homeworkshop Club held in a vacant store. Approximately 500 persons attended during three days

repair electric motors. . . The *Connellsville (Pa.)* Homeworkshop Club has begun making toys for distribution to poor children next Christmas. . . Corrin G. Chiler, Dr. B. S. Stelmaszyk, and Richard S. Kellogg, who won the prizes for the best projects at the fourth annual exhibit of the *LeRoy (N. Y.)* Homeworkshop Club, explained construction details at a meeting in the clubhouse. . . A small exhibit was entered in the Rotary Hobby Fair by the *Ashland (Ohio)* Homeworkshop Club. At each meeting the members must answer the roll call by telling what they are doing or explaining a workshop kink.

William Thomas, president of the *Hardwood Homeworkshop Club, Neenah, Wisc.*, held open house in his new, completely equipped workshop for members and their friends. He demonstrated how to operate a metal-turning lathe and a drill press.

A joint outing to be held sometime this summer has been planned by the *New Bedford (Mass.)* Timbercraft Club and the *Fall River (Mass.)* Homecraft Club. The latter group plans to sponsor a hobby show and will invite all clubs in the city to participate.



George N. Scholk with his pistol case, voted the most outstanding piece of work at the above show

Guild Membership Is Essential to Wide-Awake Craftsmen

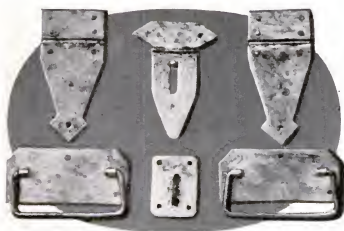
NO MATTER what your equipment may be—a kitchen table and a few tools or an elaborate shop—the National Homeworkshop Guild would like to have you as a member. Thousands of amateur craftsmen in the United States and Canada now realize that their enjoyment of the hobby increases greatly

when they belong to home workshop clubs. Full information on how you can start a club in your neighborhood and become affiliated with the Guild will be sent free upon receipt of a large, self-addressed, stamped envelope. Address the National Homeworkshop Guild, 347 Fourth Avenue, New York.

Homemade Hardware

ORNAMENTS

Treasure Chest



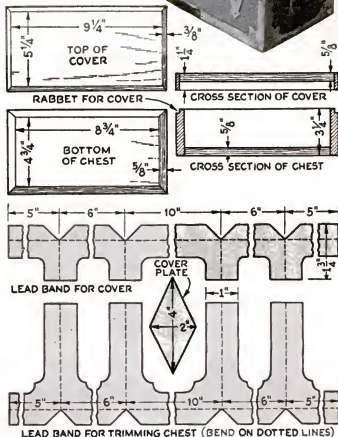
The tinned copper hardware and, above, a realistic view of the chest laden with jewelry and trinkets

A SMALL treasure chest is easily made as shown in the accompanying illustrations. The box itself is white pine or basswood, glued and nailed together. The metal trim is cut with a heavy pair of shears from a sheet of $1/16$ " thick lead, $5\frac{1}{2}$ " by 32 ". Lay the binding on all around the corners so that the ends join in the center of the box. Bend the lead to fit snugly and fasten with $\frac{3}{8}$ " No. 16 brass escutcheon pins. When the pieces have been nailed on tightly all around, bend down the $\frac{1}{2}$ " overlap on the top of the cover and the bottom of the box and nail it similarly.

Hinges, handle plate, and hasp are made from 20-gauge sheet copper, and the handles and staple from $\frac{1}{8}$ " copper wire. All are hammered lightly, assembled, then cleaned and tinned on the face side to make them blend

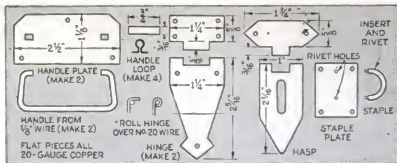


Applying strips of lead to the miniature chest. Below are the drawings



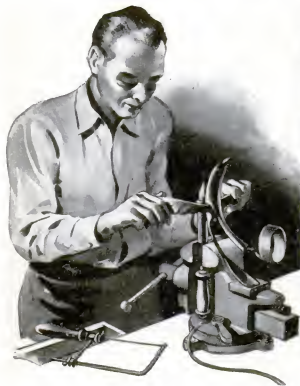
with the lead trim. The tinning is done by spreading a thin coat of solder over the surface of the heated metal, then brushing off the surplus with an old toothbrush. The hardware is applied with escutcheon pins. All the pins are left in their brass finish.

The original chest was painted with three coats of light red, but any color may be used, and the interior may be lined with velvet, if desired, to prevent the jewelry from rattling around in the box.—DICK HUTCHINSON.



Made from sheet copper and wire, the hardware is tinned with solder so that the pieces blend with the lead trim

Grotesque Birds Carved from Cattle Horns



loose, if it has not been purchased already prepared for craftwork.

Time usually can be saved by polishing the horn before starting to carve it. First it is rubbed with very fine sandpaper or emery cloth, then with rottenstone, oxide of iron, or jeweler's rouge applied on a cloth or with a buffing wheel. If the horn happens to have streaks of black, it will make a more interesting looking bird.

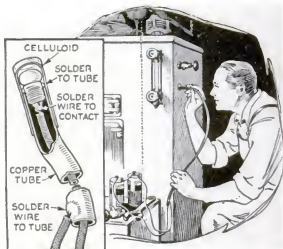
The shaping and carving are done with a fine-toothed saw, sharp knife, and files. The bend in the wings and the twists at the base are made after the horn has been softened

MANY grotesque and amusing types of birds can be carved from cattle horns. Any scratches on the horn should be removed with a scraper, and the horn should be boiled for a short time so that the bone can be dried

by boiling for about a half hour, then holding the parts to be bent over a very hot iron. The bird's body has the same curve as the horn. If a thin piece of wood is cut to fit the bottom of the horn, the base section may be used as a container for pins, paper clips, or other small articles.—J. L. CLYBURN.

Snakelike Trouble-Shooting Lamp for Use in Small Recesses

A TROUBLE-SHOOTING lamp that can be thrust into small peep holes in tanks, engine cases, and bins can be made as shown from a piece of copper tubing. An insulated wire runs through the tube and is soldered to the central contact of the flash-light bulb. The shell of the lamp socket is soldered to the end of the tube. The end of the wire is connected to one terminal of the battery, and another wire is run from the other terminal to the copper tube. A sleeve of celluloid or, better still, of cellulose-acetate film is cemented about the lamp bulb to protect it from breaking.—R. W.



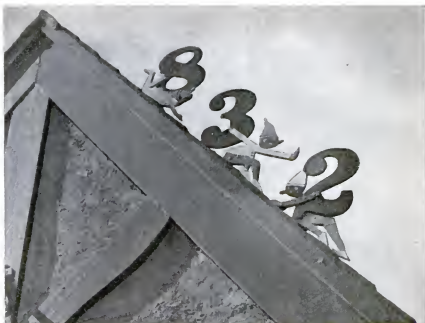
Elves

SUPPORT

House

Number

on Roof



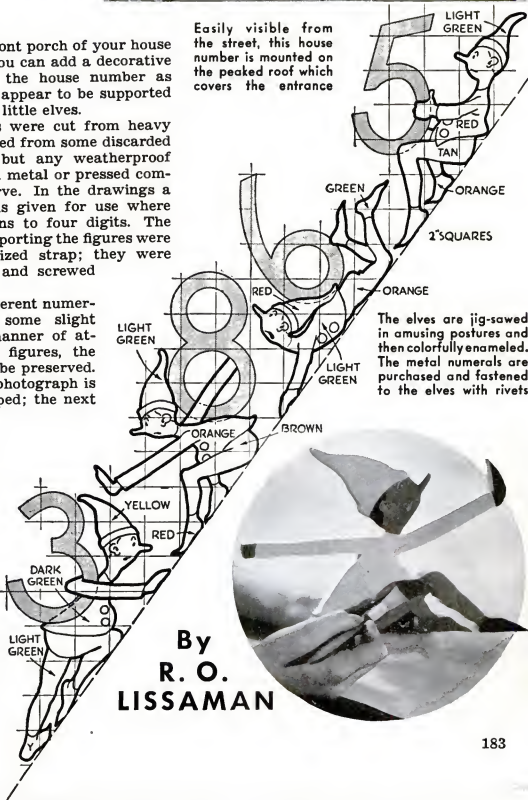
IF THE entrance or front porch of your house has a peaked roof, you can add a decorative touch by mounting the house number as shown. The numerals appear to be supported by a group of colorful little elves.

The original figures were cut from heavy red fiber board, salvaged from some discarded electrical apparatus, but any weatherproof material such as sheet metal or pressed composition wood will serve. In the drawings a fourth figure design is given for use where the house number runs to four digits. The L-shaped brackets supporting the figures were cut from $\frac{1}{8}$ " galvanized strap; they were bolted to the figures and screwed to the roof.

While the use of different numerals will necessitate some slight modification in the manner of attaching them to the figures, the general theme should be preserved. The top figure in the photograph is supposed to have slipped; the next elf has turned around as if to stop the last elf. A fourth elf, if required, can be placed at the top, looking down on the following figures.

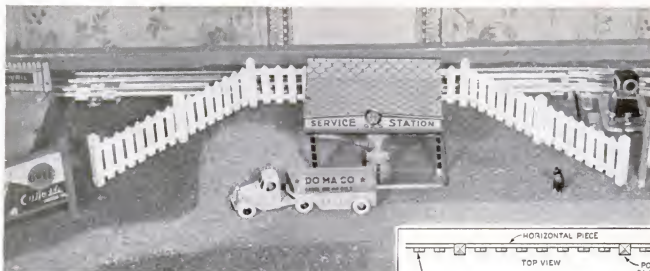
The size of the numerals will be determined to a considerable degree by the distance from street to house, although it is also necessary to preserve some sort of balance with the figures or the effect will be lost.

Easily visible from the street, this house number is mounted on the peaked roof which covers the entrance



The elves are jig-sawed in amusing postures and then colorfully enameled. The metal numerals are purchased and fastened to the elves with rivets

By
R. O.
LISSAMAN



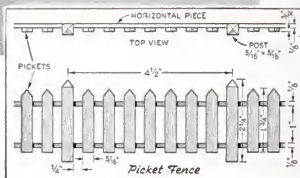
FENCES TO SUIT EVERY MODEL RAILWAY

HERE are three types of fences that will take care of practically every fence need on your model railway system. The designs are adapted from real fences, and the dimensions are scaled for O-gauge.

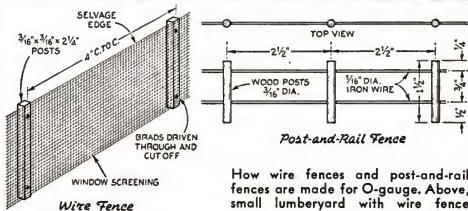
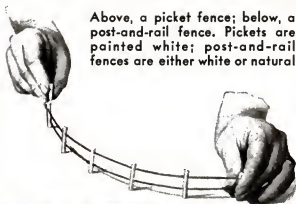
The picket fence is set around houses and lawns in the villages, or used as illustrated to set off a gasoline service station. Rip the strips for the pickets and posts the full length of a board $\frac{5}{16}$ " thick and about 18" long, using a smooth-cut saw. Cut the pieces to length by stacking several strips together and sawing through all at one time. Similarly, clamp eight or ten of the pickets together in a vise and sand the tops to shape with medium sandpaper wrapped around a wood block and used as a plane. Cut grooves in the back of the posts so the $\frac{1}{8}$ " square horizontal pieces will fit flush. Glue the parts together, spaced as indicated, by using spring clothespins as clamps.

The post-and-rail type of fence is for park areas and pastures, or it may be placed along curves in the road. Posts are $1\frac{1}{2}$ " lengths of twigs about $\frac{3}{16}$ " in diameter with the bark peeled off. Holes drilled through the posts take common baling wire.

Wire fences are placed around factories, power houses, or industrial sites. Cut the screening so a selva edge will be at the top, and nail it to the posts every 4".—C. ELMER BLACK.

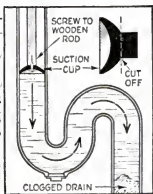


Above, a picket fence; below, a post-and-rail fence. Pickets are painted white; post-and-rail fences are either white or natural



How wire fences and post-and-rail fences are made for O-gauge. Above, small lumberyard with wire fence

Improved Plunger Opens Clogged Drain

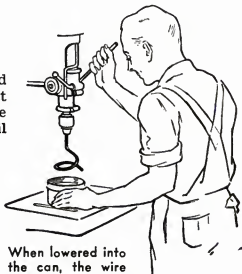


If necessary, force the plunger down the drain several times

SOMETIMES a balky sink drain, which does not yield to the pressure of an ordinary force cup or cannot be cleaned through the regular trap clean-out, can be opened by making a plunger as shown from a small rubber vacuum cup such as is used to fasten signs to show windows. Cut the projection off the back and fasten the cup with a screw to the end of a wooden rod of suitable size. Trim the rubber to a diameter only slightly larger than the drainpipe. Then remove the screen from the drain, fill the pipe with water, and force the improvised plunger in as far as possible. This will direct great pressure to the congested spot.—LOREN B. GARD.

Coiled Wire in Drill-Press Chuck Mixes Casein Glue Thoroughly

YOUR drill press may be used to mix casein glue quickly and thoroughly. Take a piece of stiff wire, such as that from a coat hanger, and bend it into a coil. Then mount one end in the chuck of the press as shown at the right. The width of the coil depends upon the size of the container.—E.C.H.



When lowered into the can, the wire coil quickly and thoroughly stirs the glue mixture

Miniature Stanchions Made of Beads

ALTHOUGH it is a trick known to experienced ship model makers, many beginners do not realize how easy it is to make poop-rail stanchions and life rails with the aid of ordinary small glass beads. I run a pin through them, then shellac them. By doing this, they do not separate when being placed under the rail. This is a much simpler way of making the fittings than turning them on a precision lathe.—S.P.R.



DOORBELLS

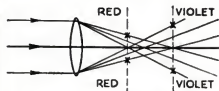
[ELECTRICAL]

If all the doorbells in a house will not ring, it is safe to assume either that the batteries are dead or, in the case of transformer-operated bells, that the fuse at the transformer has blown. If only one bell is out of order and the others ring, probably the bell is out of adjustment or worn out, or the contacts in the push button are dirty or corroded. Clean the contacts inside the bell by drawing fine sandpaper between them, and adjust so there is a slight space between them when the armature is pressed against the magnet. See that the wires at the terminal posts are tight, and sandpaper the contacts in the push button.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

Laws of Science Seen



How an ordinary lens refracts light of various colors unequally

the glass as a lens, focus the image of the candle flame on a sheet of white paper. Now move the paper toward the glass and the image will be rimmed with red; move it away, and the image will be rimmed with violet. By combining flint glass and crown glass,

CHROMATIC aberration, an optical defect that makes lenses refract light of different colors unequally, can be demonstrated by a candle and a reading glass. With

which have different refractive powers, this color dispersion is prevented and chromatic aberration is eliminated in fine lenses for cameras and telescopes.



Simple Calorimeter Tests Electric Heating Coils

A SIMPLE homemade calorimeter will measure the comparative heating effects of electric coils of different kinds and sizes of wire. Immerse the coil and a thermometer in a beaker containing a measured amount of water. Connect the coil to several dry cells, as shown above, and note the temperature of the water before and after a test. For purposes of comparison, current should be allowed to flow for an equal time in each test. If you wish to convert the resulting figures into calories, or units of heat quantity, multiply the number of grams of water in the beaker (one fluid ounce equals about thirty grams) by the temperature rise in degrees centigrade; or, if you are using a Fahrenheit thermometer, by the temperature rise in degrees and also by five ninths.

Circular Electromagnet Has No External Poles

WIND insulated wire uniformly around an iron ring. Connect the ends to several dry cells, as shown below, and you will have a magnet with no external poles. Like unmagnetized iron, it will attract either end of a compass needle. Remove the wire and cut the ring in two. Each half retains some magnetism, and, you will find, possesses definite "north" and "south" poles.



Cut the magnetized ring, and the parts have poles

in Easy Tests

How Insulators Behave in Radio Condensers

SUSPEND a small metal box or ball, with a silk thread, half an inch above the ball of an electroscope. Charge the box by touching it with a charged electrophorus, and watch the leaves of the electroscope fly apart, owing to induction across the air space. Now slip a plate of glass, hard rubber, or mica between the box and the electroscope, and note how the leaves behave. Strangely enough, these insulating materials increase the inductive effect across the air space. The amount by which a substance does this, called its "specific inductive capacity" or "dielectric constant," is of great importance in designing electrical condensers for use in radios.



An insulating plate inserted between the charged box and the electroscope increases inductive effect across the air space



Silk Handkerchief Illustrates Use of Diffraction Gratings

LOOK at a distant light, or at a small hole in a shield before a nearer one, through a white silk handkerchief of fine weave. You will see the light sparkling with rainbow colors. When the light passes through the strands of silk it is diffracted, or spread out in diverging bands. Adjacent bands, slightly out of "phase" or step in their vibrations, interfere with each other to produce fringes of colored light. The same principle is applied in diffraction gratings for spectrum analysis, made by ruling thousands of lines to the inch on glass or on metal mirrors. The greater the number of lines, the brighter and sharper will be the colors of the spectrum.

Iron Is Not Magnetic at High Temperatures

RAISE the temperature of a small piece of iron to a bright-red heat, and you will find a magnet does not attract it in the least. Let it cool, and it regains its magnetic property with almost instant suddenness at about 730 degrees F. A steel magnet, raised to bright-red heat, permanently loses all its magnetism. The degree of heat at which substances lose their magnetic properties is called the "Curie temperature."



Light viewed through a silk handkerchief is spread into bands



Here's the procedure for making slides of flower pollen. Gently brush pollen from flower's anther to slide



For permanent mounts, the natural oil of the pollen must be removed with either alcohol, dioxan, or xylol



Remove excess liquid with blotter strips. If you dye the pollen, excess dye is removed by the same method



Liquid petrolatum is a good mounting medium, often making the pollen easier to see than Canada balsom

By MORTON C. WALLING

ACHOO! Excuse me, there's a lot of pollen floating around in the air just now; and pollen means hay fever to a lot of people. But if you are a microscopist, you can turn the tables on the nose-tickling plague and go sight-seeing among the tiny specks of plant life that cause it.

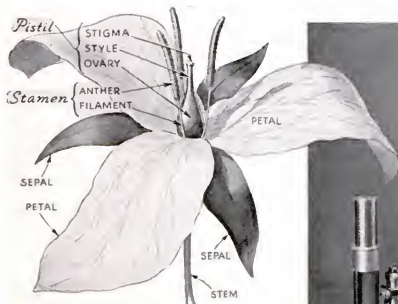
Pollen grains are so plentiful, so varied in shape, and so interesting in many other ways that they deserve the attention of every one who has a microscope. But before starting to look at them, let's examine briefly their origin.

Nature doesn't produce flowers on plants primarily to make the landscape or a dinner table pretty. A blossom is first of all a very practical means of turning out future generations of the plant; the perfume and pretty colors are merely promotional schemes, like the advertising campaigns of a manufacturer.

If you dig out your botany textbook and look up the chapter on the structure of flowers, you will find that the typical blossom is an ingenious arrangement of specialized parts. The petals and green sepals that surround them at the point of attachment to the stem are merely specialized leaves. Inside the flower are two reproductive organs. One, consisting of the stamen, produces the tiny grains that are called pollen. The pollen grains grow inside the portion of the stamen known as the anther, which is supported by the part called the filament. The other organ is the pistil, and consists of a stigma, style, and ovary. The stigma is at the outer end and usually is provided with hairs or a sticky substance. The ovary is the bulbous base portion of the pistil, and in it are produced the egg cells or ovules. There often are several stamens and pistils in a flower.

It is the union of the pollen and egg cells, usually from different flowers of a species, that produces a new plant. The mechanism of this operation will become clearer after you do a little microscope work on pollen, but briefly it is this: Ripe pollen grains, generally

Showing the Way Microscopic



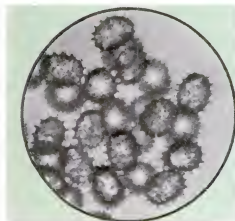
Transferring cane-sugar solution from a flask to hollow-ground slides containing pollen, for study of germination

carried from other flowers by the wind, birds, or insects, are insnared on the sticky, hairy stigma. There they grow or germinate, each germinating grain sending out a long, slender tube. The tubes grow down the style into the ovary where they unite with the egg cells. From each union there develops a tiny, embryonic plant that, after growing a while, reaches a state of rest inside the hardened shell of the ovule. In this condition it is known as a seed.

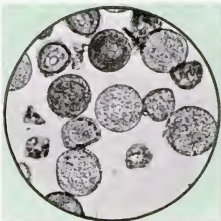
This may shatter some of your former ideas. A seed, you see, is not the true beginning of a new plant, but is merely a tiny, complete plant that has gone on a sit-down strike until it can find satisfactory growing conditions. You hear it said that seeds ger-

minate, but the true germination in the life cycle of a plant takes place when the pollen grains begin growing on the moist surface of the stigma that has trapped them.

What manner of things are these one-celled pollen grains that possess the marvelous power of reproducing, with the cooperation of the egg cell, all the characteristics of the



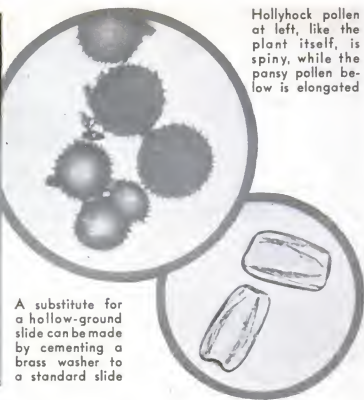
Note the spiny surface of these coreopsis-pollen grains, which causes them to cling to insects



The pollen of the common garden tulip as revealed by the strong lens of a microscope



Germinating pollen of trillium. The long "sprouts" are seeking egg cells with which to unite



Hollyhock pollen at left, like the plant itself, is spiny, while the pansy pollen below is elongated

A substitute for a hollow-ground slide can be made by cementing a brass washer to a standard slide

plant—its shape, leaf structure, size, habits, the kind of flowers it produces, and so on? For one thing, pollen grains are tiny in size, the largest barely discernible singly by the unaided eyes. They are of various shapes. They are constructed to serve as traveling colonizers, and have such aids as rough surfaces so they can cling to insects, air cells that help them travel on the wind, and tough constitutions that enable them to retain their appearances for thousands of years in swamps and peat bogs, and millions of years in coal.

POLLEN is easy to obtain for microscopic study. All you have to do is to hold a blossom above a clean glass slide and tap it a few times with a pencil, or bang it against the glass to jar the yellow grains loose. When you are out on a hike and cannot do this, you can gather the pollen in small envelopes. Or you can collect the flowers and press them in a book until dry, and obtain pollen from them at any time you desire.

The main difficulty in keeping pollen for any length of time is that it mildews if permitted to remain moist. You must dry it at once. Pressed flowers, if dried thoroughly between blotters or the leaves of a book, will preserve their pollen for a long time. Pollen gathered in envelopes can be dried by placing the envelopes in the sun or in any other warm, dry place. Some microscopists believe that the best pollen for study is that caught as it falls from the flower. Then it is quite dry, and in its natural shape. Many flowers shed their pollen freely after being cut, and it is a simple matter to arrange paper envelopes, waxed paper folded into a cone, or even clean glass beakers or tumblers to catch

the grains as they drop from the flowers.

You should examine pollen in both the dry and moist conditions. Dry pollen grains show their shapes distinctly, but for study of their structure they must be expanded by moisture. When pollen is wet by water, it sometimes behaves in an interesting manner. To see this, put some freshly gathered, living pollen on a slide, lay over it a cover glass, and focus your microscope on the grains. Then apply some water at the edge of the cover glass and watch what happens.

To prepare a permanent mount of dry pollen grains, you can proceed as follows: If the grains are covered with oil, this should be removed by putting some of the pollen on a microscope slide and dropping a little xylol on it. Carefully remove the xylol with a piece of blotter, and repeat the treatment once or twice. Then place a drop of Canada balsam on the specimen, stir the pollen around with a needle, and add the cover glass. You can stain the pollen grains for better visibility of structure before mounting them in balsam. Heating the pollen in aniline oil containing gentian violet is one method. Or you can do some research in the use of dioxan, (a solvent and dehydrating agent that will dissolve oils, balsam, and many other substances) as an aid to staining. Dioxan can be used instead of xylol for extracting the oil in the first place. An oil-soluble stain can be dissolved in pure dioxan, but a water-soluble stain requires the presence of about one part water to nine parts dioxan. If this much water does not distort the pollen grain from its natural form, you can stain the pollen, wash excess stain out with dioxan containing ten percent water, and then destain as much as desired,

stopping the stain removal at any point by replacing the dilute dioxan with pure dioxan. Mount in balsam as usual. This is something on which you can do some fascinating experimenting. You have a fertile field, for not too much is known about dioxan-and-stain relations.

Unstained pollen grains can be mounted directly in petroleum jelly or liquid petrolatum without particular preparation; and the stained ones can be similarly mounted after excess stain and solvent have been removed. Use circular cover glasses and ring them with asphalt varnish, ordinary varnish, gold size, shellac, or other sealer.

For observation of pollen structure, it is desirable to expand the dry grains by introducing moisture. First, remove the oil by treating with alcohol or dioxan. When the solvent evaporates, the oil will remain as a smear or ring on the glass slide, and can be wiped off. Stain, if desired, with a water-soluble dye, and rinse with clear water. Remove excess moisture with a blotter and then cover the pollen with glycerin or glycerin jelly. If necessary, you can drive water out of the mounting medium by heating the slide gently. Finally, cover the preparation with a thin cover glass, No. 0, if an oil-immersion objective is to be used.

It is fun to watch pollen grains germinating. You can do this easily by placing them in a weak solution of cane sugar, ranging from about three to ten percent in strength.



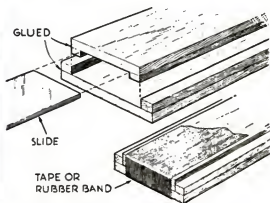
Trillium anther discharging pollen. Blown or carried to pistil of similar flower, it germinates into seed

Some pollen will not germinate in this way, but there are many kinds that will. The best way to find out about this is to try several kinds. Mix the sugar solution in a flask or tumbler, place some pollen in the depression of a hollow-ground glass slide, and add enough sugar water to fill the hollow. Lay a cover glass over the specimen, and examine the grains with a microscope every few hours. Some pollens will germinate in a short time, while others may require several days. You will be able to see clearly how the tubular "sprouts" break out (*Continued on page 228*)

Make Your Own Mailing Cases for Slides

DO YOU like to exchange slides and specimen material with other microscopists? If so, the compact slide holder shown in the illustration below will protect them when they are sent through the mails. Use a stiff

material such as thin wood. If it is thin enough, you can cut the parts out with a sharp knife or a razor blade. For mailing, just place the slide in position, fasten the parts together with string, tape, or rubber bands, and place the container in an envelope for addressing. It is always a good idea when mailing the cases to mark them plainly with the word "fragile."



FUN with

HOME EXPERIMENTS WITH



A drop of water acts as a catalyst to produce this spectacular reaction between iodine crystals and metallic aluminum powder

as chlorine and hydrogen form hydrogen chloride, or hydrochloric acid. Hydrobromic acid reacts with substances to form bromides, as does its better-known relative, hydrochloric acid, to form chlorides.

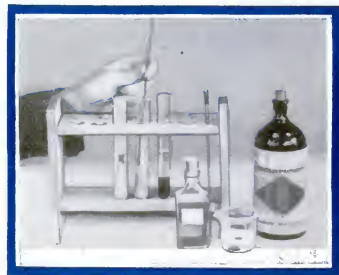
Unlike most acids or acid-forming gases, however, hydrogen bromide cannot be prepared for practical purposes by heating corresponding salts with strong sulfuric acid. It is formed in the reaction, to be sure, but it is rapidly decomposed by the oxidizing action of the sulphuric acid. This difficulty is overcome by heating a bromide with strong phosphoric acid, which does not decompose the product.

To make hydrogen bromide, place a half ounce of potassium bromide or sodium bromide in an Erlenmeyer flask or a retort, with a capacity of sixty to 200 cubic centimeters (two to seven fluid ounces). Cover the chemical to a depth of an eighth of an inch or so with strong phosphoric acid, which you can buy at any drug store under the name of eighty-five-percent, or sirupy, phosphoric acid.

Arrange tubing to lead from the flask or

WHENEVER the members of the halogen family put on an act, you can be sure there will be something doing in the way of entertainment. The nimblest of the family quartet undoubtedly is chlorine. You have seen this actor in several rôles before—bleaching dyes, and attacking metals with accompanying pyrotechnics, for example—if you have followed this series of articles. Iodine has made a personal appearance before you as a chemical detective, revealing latent fingerprints on paper. Another member of the family, fluorine, has shown you its remarkable power of etching glass when teamed with hydrogen. The remaining member of the quartet, bromine, is an irritating, rascally sort of character if encountered alone. However, when handcuffed to hydrogen, its behavior is so satisfactory that you should let it enter your home chemical laboratory and allow it to perform for you.

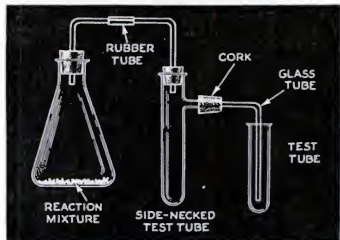
Uniting bromine with hydrogen yields hydrogen bromide, or hydrobromic acid—just



Oxygen formed by the decomposition of a hypochlorite solution makes a glowing straw flare up

the HALOGENS

A FAMOUS CHEMICAL FAMILY



Making hydrogen bromide from potassium or sodium bromide and phosphoric acid. The vapor collects in the test tube at the far right

retort to the bottom of an empty side-necked test tube, which will serve as a catch bottle to condense water vapor distilled from the phosphoric acid. At the test tube's side neck, attach more tubing that will conduct the hydrogen bromide vapor to the bottom of a test tube for collecting the gas. This test tube may be left open, and the gas, being heavier than air, will displace it and fill the tube.

Apply heat to the flask or retort, with a Bunsen burner, and hydrogen bromide gas will be generated. It will pass through the system into the last test tube. Meanwhile a teaspoonful or so of useless condensate will collect in the side-necked test tube.

Collect a tubeful of hydrogen bromide gas and then pour it, as if it were water, into the air. A white cloud forms as the gas combines with moisture in the air.

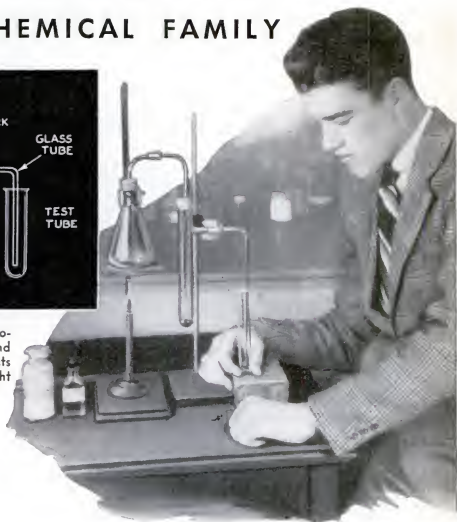
Hold an object moistened with ammonium hydroxide (household ammonia may be used) in the stream of hydrogen bromide gas from your apparatus. Dense white clouds of ammonium bromide will be formed. This resembles the formation of similar clouds of ammonium chloride, when hydrogen chloride (hydrochloric acid gas) comes in contact with ammonia.

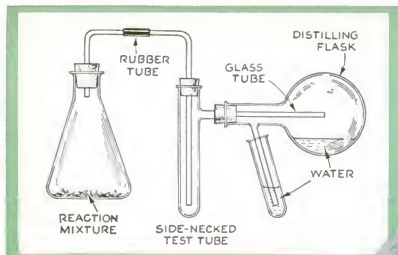
If hydrogen bromide is heated,

it decomposes into its constituents, hydrogen and bromine. To show this, soak a sheet of filter paper in an alcoholic solution of fluorescein, and dry it. Then dampen the yellow-stained paper with water and wad it into the mouth of a test tube filled with hydrogen bromide gas. Hold the test tube in a Bunsen flame. The heat will release free bromine, which will change the hue of the paper to a reddish coloration. The bromine reacts with the fluorescein to form eosin, a red dye. This test for free bromine can also be adapted to tell whether a salt is a bromide. Usually it is sufficient to heat the salt with strong sulphuric acid, in a test tube plugged with the fluorescein test paper as before. If the salt is a bromide, hydrogen bromide will be formed and the sulphuric acid will decompose it, releasing free bromine and turning the paper pink or red.

Close a test tube of hydrogen bromide gas with your thumb, invert it, and open it under water. As the gas dissolves, water will rise in the tube. The solution of hydrogen bromide in

By
**RAYMOND B.
WAILES**

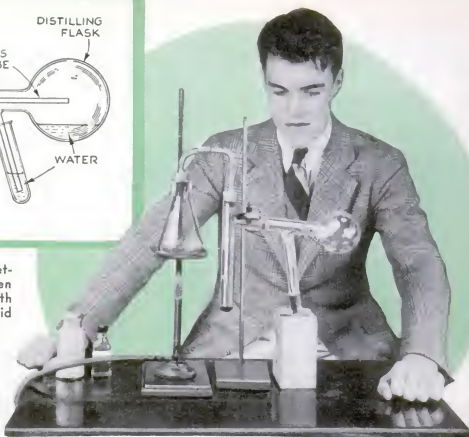




By adding a distilling flask to the set-up on the preceding page, the hydrogen bromide gas is brought in contact with water to form liquid hydrobromic acid

water is known as hydrobromic acid—just as hydrogen chloride, dissolving in water, forms hydrochloric acid. So soluble is hydrogen bromide gas that 612 volumes of it can be dissolved in one volume of water.

To make hydrobromic acid solution for your tests, you could simply let the gas from your apparatus bubble through water in a test tube. A better way, however, is to fit a distilling flask to the side-necked test tube by means of a cork attached to the side neck. The distilling flask should contain about ten cubic centimeters (three teaspoonfuls) of water, and its arm, pointing downward, should dip into the same quantity of water in



a test tube, as shown in the illustration.

Hydrogen bromide gas from your apparatus first passes into the bulb of the distilling flask, where the water greedily absorbs it. Any gas not recovered here will dissolve in the water-filled test tube below. After letting the gas bubble through the system for several minutes, disconnect the distilling flask, and combine the solutions that the distilling flask and test tube contain.

LEATHER BELT DRESSING

[FORMULAS]

Melt together the following:

| | | | |
|------------|-------|-----------------------|-------|
| Spruce gum | 5 oz. | Ozocerite or cerasine | 1 oz. |
| Rosin | 3 oz. | | |

Remove the molten mixture from the fire and add 2 oz. of turpentine.

When the preparation is cold, add 10 oz. of alcohol. Shake before using.

The dressing should be applied with a brush on the inner side of the belt.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

This solution of hydrobromic acid, you will find, has distinctly acid properties. In fact, it is strong enough to dissolve metals such as zinc and magnesium. Drop small quantities of these metals into portions of the liquid, and hydrogen gas will be evolved. The metal itself is converted into a bromide salt.

Hydroxides of the various metals are easily dissolved by hydrobromic acid. You can make some copper hydroxide for this test by adding a small amount of ammonium hydroxide to a clear solution of copper sulphate, and filtering to recover the resulting precipitate. This solid residue of copper hydroxide will readily dissolve when you pour some of your hydrobromic acid solution upon it.

With iodine, another member of the halogen family, you can carry out a mysterious and spectacular experiment. This test calls for solid iodine crystals (not the liquid "tincture of iodine" used as an antiseptic, which is a solution of the crystals in alcohol) and should be performed outdoors.

Mix a quantity of the iodine crystals with about twice their volume of metallic aluminum powder, such as is used in aluminum paint, by thorough stirring in a bone-dry porcelain crucible or tin-can lid. So far, no reaction has taken place. Now add a drop of

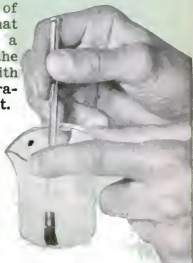


Bromine released by heating hydrogen bromide colors filter paper saturated with a reagent

Laboratory "Policeman"

A USEFUL little device for collecting the last particles of a precipitate from a beaker is called a "policeman." To make one, slip an inch-long piece of rubber tubing over the end of a glass stirring rod, or over the closed end of a glass tube. Close the outer third of the rubber tubing, in turn, by inserting a little tire cement and letting the adhesive dry under the pressure of a screw clamp. This will form a small rubber tab that flexes nicely on the end of the rod, for scraping out a bit of precipitate that adheres to a beaker. Keep the "policeman" with your other laboratory equipment.

The "policeman" on duty. It is handy for collecting precipitates from the bottoms of glass beakers



water to the mixture. In several seconds, when the water wets the aluminum metal, things commence to happen.

The iodine-aluminum mixture becomes warm. Suddenly it glows with a soft, red hue. Purple fumes of iodine vapor issue from the mass. (It is to dissipate these fumes that the experiment is performed outdoors.) While the vapor is being emitted, the mixture will continue to glow. Then, as it starts to cool, the dying glow of the aluminum oxide—formed when the aluminum burns in the air—is spontaneously rekindled to brightness. This phenomenon is known as "recalescence." Finally a cold, twisted residue is left.

Curiously, the drop of water took no chemical part in the reaction; it simply acted as a catalyst or "trigger" to set things going. No one seems to know just how or why a catalyst works. But in some mysterious way it makes certain chemicals interact, simply by its presence.

Here is an experiment with another compound of the halogen family—a hypochlorite—which shows that two catalysts are sometimes better than one.

For the hypochlorite used in this test, you can make a solution of calcium hypochlorite by dissolving (*Continued on page 230*)

NEW IDEAS FOR



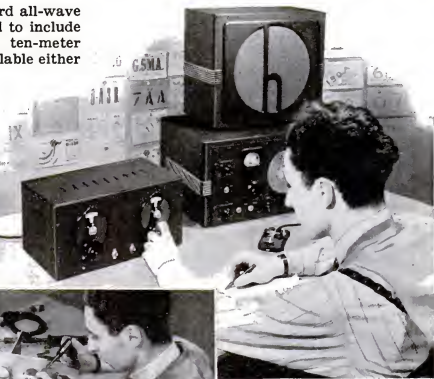
The mirror back and bracket increase the pick-up area

Novel Car-Radio Aerial Combined with Mirror

EASILY installed on any automobile, a one-piece unit now on the market combines a car-radio antenna and a rear-view mirror. Fitted with a shielded lead-in cable and suitably insulated, the telescoping rod antenna uses the entire surface of the bracket and mirror back for signal pick-up, in addition to its own area. This gives it approximately two and a half times more area available for signal pick-up than is found in many other types of automobile aerials, a factor that provides superior radio reception, according to the manufacturer. The combination unit is installed so that the mirror eliminates the blind spot behind the rear left-hand corner of the car, which cannot be seen by the driver through the conventional mirror usually mounted inside of the car body.

5-10 Meter Converter Comes in Kit Form

TUNING coverage of any standard all-wave or short-wave receiver is extended to include the ultrahigh-frequency five and ten-meter bands by a compact converter available either in kit form or as a complete ready-to-operate unit. Employing three tubes, and a series of plug-in coils, the converter requires no alterations in the receiver with which it is used. Once connected to a standard radio, all ultrahigh-frequency tuning is done with the dials of the converting set, as shown at the right.



The converter in use. All ultrahigh-frequency tuning is done with dials of the converter set



If desired, the converter can be purchased in kit form with complete instructions for assembling at home, as at left

THE RADIO FAN



Clamp Makes Antenna out of Metal Bed

A METAL bed can be made to serve as an antenna for a bedside radio by using the simple device pictured above, which can be made at home. The two rubber vacuum cups are attached to the bed frame, and a threaded shaft screwed down until its point penetrates the enamel and contacts the metal underneath. A wire leading to the radio antenna post is soldered to the unit.

Midget Controls Larger Set

IN ADDITION to providing direct radio reception itself, a miniature receiver just introduced will act as a remote-control unit to operate a set at a distance, and, when connected to a record player, will reproduce recorded music either through its own loudspeaker or remotely through another radio.



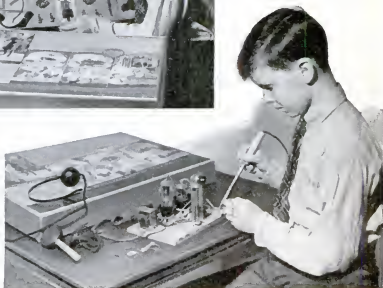
Using the new miniature for remote control of a larger set

Construction Set Offers Miniature Radio Laboratory

A MINIATURE radio laboratory is now put up in kit form for radio enthusiasts to make many of the devices in daily use in commercial radio stations and experimental testing rooms. Packed compactly in a cardboard box with full instructions that even inexperienced radio fans, or beginners, can follow easily, are all of the parts that are required to make a complete radio receiver, an electric code-practice set for learning the code or for increasing sending and receiving speed, a relay that will turn lights on and off, and a number of other practical electric devices. Also included in the kit is an electric soldering iron and a spool of solder, which every amateur radio fan should learn to use.

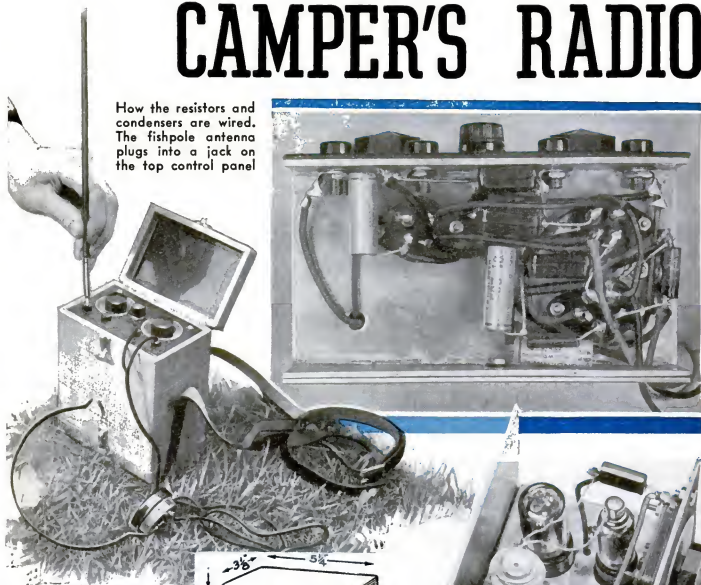


The beginner's radio kit and its contents. Below, a tyro radio engineer puts the final touches on a receiver assembled from parts supplied with the kit



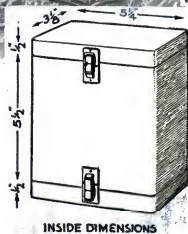
CAMPER'S RADIO

How the resistors and condensers are wired. The fishpole antenna plugs into a jack on the top control panel



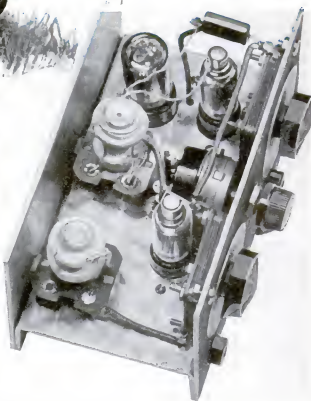
SMALL enough to be slung over your shoulder like a camera, this lightweight portable has its own built-in battery supply and uses an ordinary steel fishing rod as an antenna. Housed in an attractive yet sturdy cloth-covered cabinet, the midget earphone set forms an ideal companion for use on camping and fishing trips, picnics, and long automobile tours.

Three of the latest-type midget tubes form the basis for the compact circuit. Operating on a filament voltage of $1\frac{1}{2}$ volts and a plate supply of 45 volts, the tiny tubes not only make it possible to pack a three-tube hook-up into a small amount of space, but they cut down the number of necessary batteries to a minimum—a 45-volt "B" battery and a small $1\frac{1}{2}$ -volt dry cell. These tubes, of English manufacture, can be obtained from almost



INSIDE DIMENSIONS

The chassis and panel assembly at the right fits snugly into the top of the compact cabinet



any large radio-parts supply house and must be used with the special midget sockets designed for them. In wiring the tubes, bear in mind that the metal connection at the top of each XSG tube is not the grid, as on most American tubes, but the plate.

To obtain the highest possible volume, iron-core coils are used. However, to save space they should be removed from their aluminum shielding cans. To obtain the necessary feedback in the detector or second coil, fifteen

Uses Fishpole Antenna

By FRANK TOBIN

turns of No. 28 double-cotton-covered wire should be mounted close to the grid winding. This is indicated in the wiring diagram.

As in the Terrace Portable described last month, composition-insulated tuning condensers are used instead of the usual air-spaced variety. They cost no more, and do conserve space. However, since these condensers cannot be ganged or mounted on a single shaft, each stage must be tuned separately.

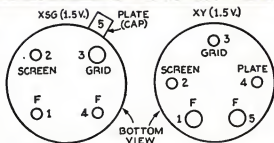
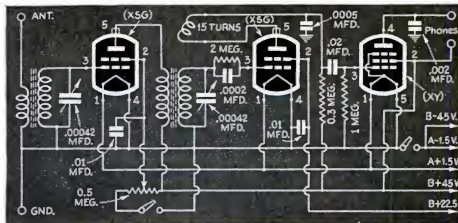
A 500,000-ohm variable resistor connected across the "B" battery serves to control the volume. To avoid any unnecessary drain on the batteries while the set is not in use, a switch should be placed in the ground lead of the volume control. This switch can be ganged with a second switch placed in the minus lead to the "A" battery, so that both then can be controlled by a single knob on the panel.

The cabinet used for the original set illustrated was made of wood and covered with airplane cloth. If you desire, it can be covered with imitation leather. To simplify the problem of changing the battery supply, two hinged covers are used—one at the top to cover the control panel and the other at the bottom to close the battery compartment. A leather strap run through leather loops mounted on the sides of the cabinet makes it easy to carry the receiver.

No ground is needed in operating the set, only an antenna, which need be nothing more than the business end of an inexpensive telescoping steel fishing rod. For the original, the author sawed about $\frac{3}{8}$ " from the bottom end of the main ferrule that fits into the socket in the fishing-rod handle and soldered a short banana-type plug in place. This plug fits in a small jack mounted in the lower left-hand corner of the control panel as shown



If you wire the receiver carefully according to the diagram below you will be able to get good radio reception miles from home



Follow these socket diagrams when making the various connections to the three tubes



Two small batteries housed in the bottom of the cabinet form the tiny receiver's complete battery supply

in one of the photographs. If desired, a wire from the antenna plug can simply be clipped to the end of the fishing-pole handle. As a matter of fact, the receiver can be used while fishing—the steel rod serving not only to catch fish, but to snare the radio waves. In this case, however, the fishing rod must be one fitted with a cork or other nonconducting handle to insulate the antenna and eliminate body capacity.

In laying out the parts and wiring, follow the photographs and diagram closely. The tubes and coils have been arranged with an eye to compactness and ease in wiring. Be particularly careful in making the connections to the three tube sockets, and follow the socket diagrams to the letter.

LIST OF PARTS FOR CAMPER'S RADIO

Volume control, 500,000 ohms.
 Iron-core antenna coil.
 Iron-core radio-frequency coil.
 Variable condensers, two, .00042 mfd.
 Fixed resistor, 2 megohm, $\frac{1}{2}$ watt.
 Fixed resistor, 1 megohm, $\frac{1}{2}$ watt.
 Fixed resistor, 300,000 ohms, $\frac{1}{2}$ watt.
 Tubular condensers, two, .01 mfd.
 Tubular condenser, .02 mfd.
 Mica condenser, .002 mfd.
 Mica condenser, .0002 mfd.
 Mica condenser, .0005 mfd.

Miscellaneous: Tubes (two XSG, one XY), one 45-volt "B" battery, one $1\frac{1}{2}$ -volt midget dry cell, chassis, cabinet, special tube sockets, switches, four insulated plugs and jacks, cabinet, fishing-pole, knobs, dials, wire, solder, etc.

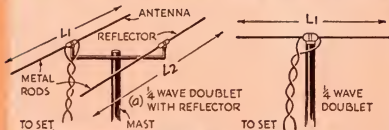
HOW TO Install

THE problem of setting up an efficient television antenna for yourself or one of your friends will be greatly simplified if you will follow a few simple rules. First of all, although television antennas may vary in appearance and size, they are basically all alike, consisting of a quarter-wave doublet antenna of predetermined length. A "reflector" antenna, similar in design but from eight to ten inches longer, is mounted beside the doublet when necessary to eliminate "ghosts," or unwanted, out-of-register duplications of the television image on the fluorescent screen. Such ghosts usually are caused by a reflection of the signals from near-by buildings, just as visible light waves—which television waves resemble in many characteristics—reflect from a wall or other surface.

It is advisable to have a helper when setting up the antenna, so that one person can adjust its position while the other tests the operation of the receiver. Locate the antenna in a clear space on the high-



a Television Antenna

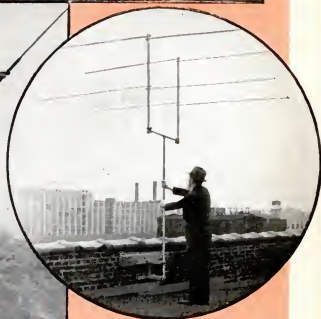
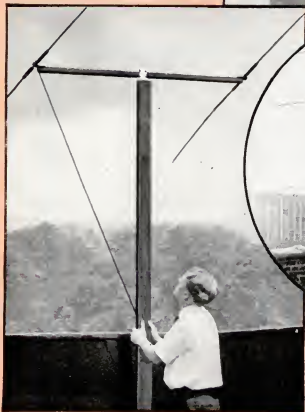


| FREQUENCY | L ₁ | L ₂ |
|---------------|----------------|----------------|
| (a) 44-56 MC | 122 INCHES | 134 INCHES |
| (b) 66-72 MC | 83 INCHES | 93 INCHES |
| (c) 78-90 MC | 70 INCHES | 80 INCHES |
| (d) 96-109 MC | 58 INCHES | 66 INCHES |

NOTE: REFLECTOR IS ALWAYS 8 TO 12 INCHES LONGER THAN RECEIVING ANTENNA

est possible part of a building, and on the side toward the transmitter. If the antenna and receiving set are not within easy shouting distance much time can be saved with a two-way, portable telephone system strung up temporarily between the two points.

Television antennas should be mounted on a wooden or an iron mast of substantial design, securely anchored to the building. They are usually furnished properly matched for the 45 to 55-millicycle "vision" transmitters. If your local television station operates on a different frequency, the metal rods must be cut to the overall lengths shown in the accompanying table. Regardless of its design, the antenna will have to be rotated until the maximum signal strength is obtained, which is usually when the quarter-wave rods are at right angles to a line between the antenna and the transmitter. Several commercial antennas are fitted with flexible couplings which simplify this adjustment.



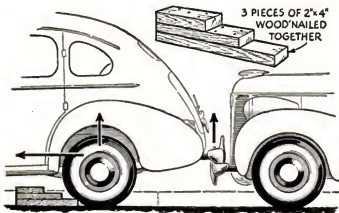
Several types of antennas. A two-way telephone between the set and antenna helps to make adjustments

Helps for Car Owners



Bottle Opener for Picnics

THERE'S no chance of forgetting a bottle opener, the vital tool on a picnic, if you attach one to the steering post of your car. It is easily installed with clamps designed for mounting a windshield-defrosting fan.—D.P.C.

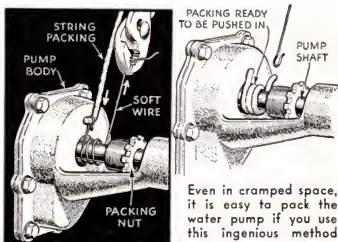


Easily Made Block Steps Untangle Locked Bumpers

IN CASE your car locks bumpers with another, a handy unit to have stowed away in your luggage compartment is an easily made pair of block steps made from two-by-four lumber. As illustrated above, one set is placed under each near wheel of the "top" car, which is then driven onto the steps to lift its bumper clear of the other car. The steps fit together for compact storage.—R. C.

Soft Wire Winds Packing on Water-Pump Shaft

REPACKING water pumps in the cramped space found on pumps of most late-model cars is made easier by using a two-foot length of soft, flexible wire. Loosen the packing nut and then wrap three turns of the wire loosely around the shaft, as pictured below. Attach one end of a piece of string-type packing to a loop in the wire. Gently pull the wire and the packing will wind itself into place. In the drawing, the space is exaggerated in order to show details of the process.—J.H.B.



Even in cramped space, it is easy to pack the water pump if you use this ingenious method

Removing "Collision" Paint

WHEN two cars scrape fenders, the lacquer or enamel color from one is sometimes transferred to the other. Either as a permanent repair job, or to eliminate an unsightly splotch until the fender can be repainted, the blemish can be removed by rubbing with a lacquer rubbing compound, which can now be bought in small quantities.—W.E.B.



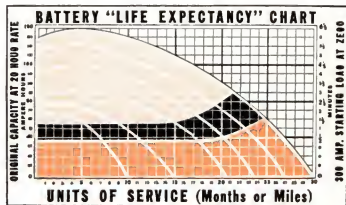
Paint scraped from another car is rubbed off quickly



X marks the spot . . . where your battery may go dead when you need it most!

But you don't have to gamble on when your battery will give out! You don't have to take the chance of finding your car "dead" in the morning, or of paying out your good money for a recharge on a worthless battery. Now you can *know* when a battery is about through—simply by checking it up with the Battery "Life Expectancy" Chart.

The Battery "Life Expectancy" Chart was prepared after extensive research into the average life of various size batteries. This information was assembled and plotted into curves on a chart to show how many months of useful life can be expected from a battery at any point in its service. The chart covers batteries of all sizes—from 60 ampere hours to 150 ampere hours.



More than 5,000,000 Delco batteries are in service every day on leading makes of passenger cars and trucks. Because of their proved dependability, Delco batteries are specified as standard equipment on all General Motors passenger cars, commercial cars and trucks.



Delco-Remy

ANDERSON, INDIANA

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See your Delco battery dealer today. Have him explain the Battery "Life Expectancy" Chart to you, and let him show you when your battery should be replaced to avoid the inconvenience of complete battery failure. Ask him also to show you the Delco Battery Tester, which determines the size battery you require to take care of your particular starting, lighting and accessory requirements.

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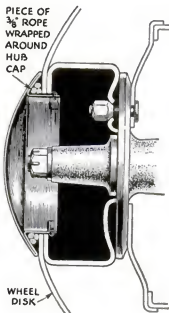
BY THE MAKERS OF MOBIL OIL

Door-Handle Cushions for Close Parking

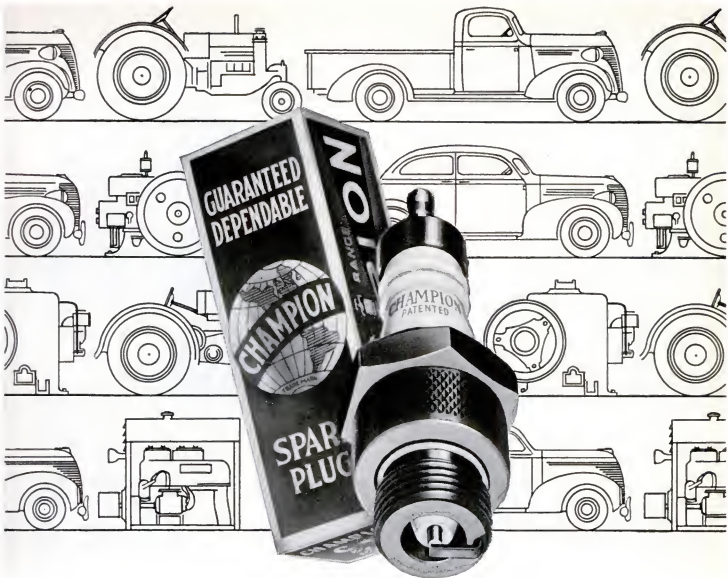


WHEN two cars are kept side by side in a double garage, there is always the danger of the door handles of one car accidentally striking and marring the body or paint job of the car alongside, as the owner opens the door to get in or out. To prevent this, I made a set of handle cushions by obtaining a length of small-diameter rubber hose at a drug store, cutting it into two sections of the required length, and slipping it over the handles, as shown in the illustration above. If the cars are always placed beside each other in the same relative positions in the garage, the finish-protecting handle cushions will be required only for the doors on one side of each car.—W. H. G.

Rope Silences Hub Cap



TO STOP the rattle of worn hub caps, motorists can wind a piece of rope in the recess between the flange and the edge of the cap, as shown in the sketch at the left. A single turn of $\frac{3}{8}$ " rope will be satisfactory for most cars, or smaller cord can be used by employing more than one turn to fill up the space as needed.—T. F. J.




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V-PLUG**



**V- $\frac{3}{8}$ " 24 Thread
V2- $\frac{1}{4}$ " 32 Thread
65c**

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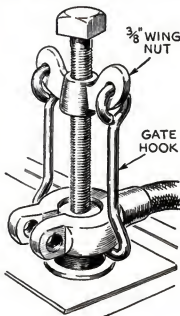
Saddle Soap Cleanses Leather Upholstery



ORDINARY saddle soap, generally used for cleaning and polishing harness, is also excellent for refurbishing leather automobile upholstery, particularly the light-tan variety found in many roadsters and open touring cars. Rubbed on with a soft cloth, the soap not only cleans the leather effectively, but also gives it an attractive polish and makes it soft and pliable.—N. R. B.

Homemade Tool Loosens Stubborn Battery Lugs

BATTERY lugs that are stuck tight can be removed with the tool pictured below. Twist two short gate hooks so that the eye and hook ends are at right angles. Suspend these from holes bored through the ears of a ¾" wing nut. Screw the wing nut onto a bolt with a square head, and set the bolt on top of the battery post with the hooks slipped under the battery-terminal lug. Turning the bolt head with a wrench will loosen and lift the lug, without putting a strain on the seating of the battery post.—A. H. W.



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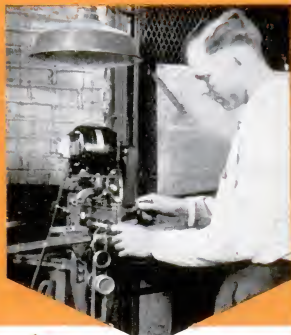
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All of the projects listed below have been illustrated in the magazine. For the benefit of readers who would like to look up those pictures, a reference to the date and page of issue is given in parentheses after each item. A complete list of our plans will be sent free upon receipt of a stamped, self-addressed envelope.

MODELS

| | |
|---|-------|
| Barnegat Lighthouse, 10 $\frac{1}{2}$ " high (illustrated in P.S.M., Oct. '36, p. 61), 298A..... | \$.25 |
| Clipper Ship GREAT REPUBLIC, 5 $\frac{1}{2}$ " hull (Dec. '35, p. 59), 272-273-274..... | 1.25 |
| Clipper Ship SEA WITCH, 9 $\frac{1}{2}$ " hull (Dec. '33, p. 96), 219..... | .25 |
| Coast Guard Patrol Boat of 185' Type, 20 $\frac{1}{2}$ " hull (July '36, p. 55), 286-287-R..... | .75 |
| Confederate Raider ALABAMA, 21 $\frac{1}{2}$ " hull (Feb. '38, p. 77), 335-336-337-R..... | 1.50 |
| Elizabethan Galleon REVENGE, 21" hull (Apr. '33, p. 65), 206-207-208-209..... | 1.00 |
| Farragut's Flagship HARTFORD, 33 $\frac{1}{2}$ " hull (Jan. '34, p. 57), 221-222-R..... | 1.50 |
| Fishing Schooner WE'RE HERE of 'Captains Courageous,' 7 $\frac{1}{2}$ " hull (Oct. '38, p. 172), 351-R | .50 |
| Harbor Tugboat and Barge, miniature water-line models 5 3/16" and 7 3/16" long respectively (June '36, p. 71), 285..... | .25 |
| H.M.S. BOUNTY, 8 $\frac{1}{2}$ " hull (Apr. '35, p. 68), 254 | .25 |
| Liner NORMANDIE, 20 $\frac{1}{2}$ " hull (Oct. '35, p. 57), 264-265..... | .50 |
| Liner QUEEN MARY, 10 $\frac{1}{2}$ " hull (May '36, p. 74), 283 | .25 |
| Liner PRESIDENT LINCOLN, 14 $\frac{3}{8}$ " long (Aug. '37, p. 88), 325..... | .25 |
| Locomotive, Hudson type, Ho gauge, 14" long, driven by 6-volt motor (Nov. '37, p. 89), 329-330-R..... | .75 |
| New Bedford Whaleboat, with complete equipment, 14" hull (Sept. '37, p. 104), 326-R..... | .50 |
| Ocean Freighter, 14" hull (Oct. '35, p. 57), 271..... | .25 |

(Continued on page 210)

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Plans for the Workshop

(Continued from page 208)

| | |
|---|------|
| Old Naval Cannon, a six-pounder in battery, period about 1798; gun is $7\frac{1}{2}$ " long, model over all is 9" by $11\frac{1}{2}$ " (Nov. '38, p. 170), 352..... | .25 |
| Privateer SWALLOW, a Baltimore clipper, 13" hull (Nov. '34, p. 65), 228-229-230-R..... | 1.00 |
| Trading Schooner, three-masted, $17\frac{1}{2}$ " hull (Mar. '35, p. 65), 232-233..... | .50 |
| Yacht NOURMAHL, 8 $\frac{1}{2}$ " hull (Jan. '36, p. 61), 276..... | .25 |

BOATS

| | |
|---|------|
| Cabin Cruiser, 17' long, weighs 750 lb., for use with inboard or outboard motor from 2 to 10 h.p. (Feb. '39, p. 161), 356-357-358-359-R..... | 1.50 |
| Camper's Utility Boat, 11' 2" long, canvas-covered, weighs 100 lb., for outboard motor or rowing (Apr. '36, p. 64), 281-R..... | .50 |
| Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p.; can also be rowed (July '38, p. 55), 344-345-R..... | .75 |
| High-Speed Boat for Small Outboard Motors, 7' 11" long, weighs 75 lb. (May '35, p. 59), 257-R..... | .50 |
| Racing Runabout, 13' steps hydroplane for outboard motor, weighs 275 lb. (June '35, p. 60), 261-262-R..... | .75 |
| Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged (July '37, p. 71), 321-322-323-R..... | 1.00 |
| Sectional Rowboat, 9' 8" long, weighs 60 lb., all-wood construction; can be used with small outboard motor (Apr. '38, p. 69), 340-341-R..... | .75 |
| Sport Runabout, 9' 8" long, weighs 100 lb., for small outboard motors (Apr. '37, p. 71), 309-310-R..... | .75 |
| Utility Rowboat, 13' long, weighs 175 lb.; can also be sailed or driven by outboard motor (Aug. '34, p. 84), 224-R..... | .50 |

FURNITURE

| | |
|--|-----|
| Early American End Table (Dec. '38, p. 180), 361A..... | .25 |
| Filing Case, table height of 30" (Feb. '39, p. 172), 365A..... | .25 |
| Maple Tavern or Long Table, colonial; top is 30" by 68" (May '37, p. 80), 318A..... | .50 |
| Modern Tea Wagon and Cabinet into Which It Rolls (Apr. '37, p. 53), 313A..... | .25 |
| Queen Anne Dressing Table, Stool, and Mirror (Dec. '36, p. 74), 295A..... | .75 |
| Six-Footed Coffee Table, 14" high; top is 14" by 26" (Sept. '37, p. 103), 327A..... | .25 |
| Small Early Colonial Pine Chest, 32" long, 21" deep, 24" high (Mar. '37, p. 87), 308A..... | .25 |
| Special Bookcase for holding forty-eight issues of Popular Science Monthly (Oct. '38, p. 216), 353A..... | .25 |

MISCELLANEOUS

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|--|-----|
| Beginner's Battery Radio (Feb. '39, p. 223), 365A..... | .25 |
| Bicycle Trailer (Apr. '39, p. 161), 367A..... | .25 |
| Cigarette Holder, designed in form of miniature three-gun naval turret (Feb. '37, p. 91, 299A..... | .25 |
| Electric Scoreboard for Basketball (Oct. '38, p. 184), 353A..... | .25 |
| Photographic Split-Image Range Finder (June '39, p. 163), 366A..... | .25 |
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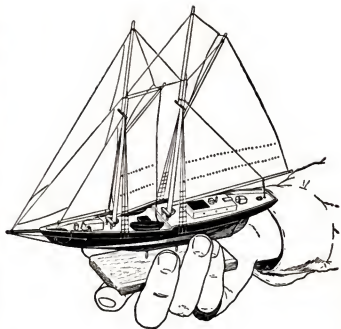


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| G. Elizabethan galleon REVENGE, 25" hull, 28" over all..... | 7.25* |
| L. Farragut's flagship HARTFORD, steam-and-sail sloop-of-war, 33½" hull, 41" over all..... | 8.45* |
| Q. Privateer SWALLOW, a Baltimore clipper, 12½" hull, 20" over all..... | 4.95† |

(Continued on page 214)

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(Continued from page 212)

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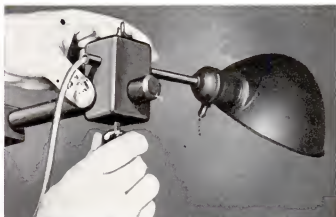
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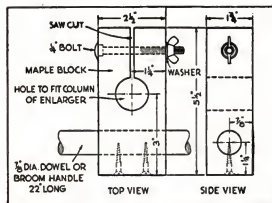
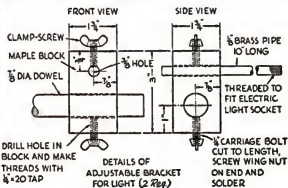
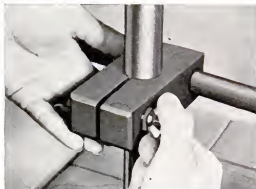
EFFICIENT Copying Set-Up FOR MINIATURE CAMERA



A fully adjustable bracket, made mainly from wood, enables the lamps to be arranged for copying or photographing very small objects



How the hardwood clamp blocks are made and assembled to hold the lamps

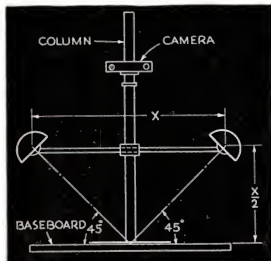


IN COPYING with the camera or photographing small objects close up, correct lighting and correct exposure are most important. When a miniature camera is used for this type of work, the regular enlarger baseboard and column will serve advantageously to support both the camera and a homemade light bracket of the type illustrated.

Details of the bracket are given in the drawings. All holes should fit snugly for smooth operation, and a drop or two of heavy oil in the wood threads will allow the clamp screws to work easily. Ordinary light sockets having a thread on the end to take standard reflectors are used, and the wires extend through the tubing and are connected in parallel to a single plug. Paint all parts a dull black.

For copy work, lights of equal brightness should be used in the standard 45 deg. set-up in order to obtain even, glareless illumination of the object. When small objects are to be photographed, however, the lights may be shifted in or out of the bracket by the brass tubing, as well as side to side on the cross rod or up or down on the column.

To establish standard working conditions in either type of work, fix the lights in position and note their location above the object and their distance from the camera. Make a series of trial exposures and tabulate the results so that the correct exposure will thereafter be known under the same conditions.—C. E. B.



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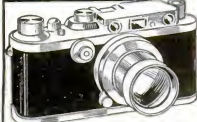
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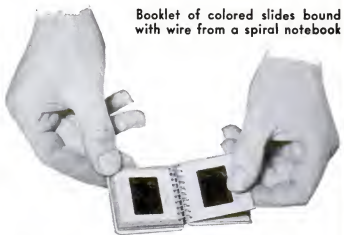
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The slides are stacked and clamped between pieces of wood while the holes for the binding are drilled

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Setting Up Movie Camera to Shoot Titles

IF A BASEBOARD of plywood or thick pasteboard is made as shown above, you can quickly set up your movie camera for titling or taking animation and other close-up pictures. The base is notched to receive the tripod legs, and the approximate area the camera lens will cover at this close range is outlined on the board. Different areas may be outlined for lenses of various focal lengths or to correspond with different heights of the tripod. For most close-up work, a satisfactory lighting arrangement may be obtained by placing two flood lights on a tripod leg as illustrated. The device is ideal for photographing only hands.—M. G. W.

Paint Spot Removed from Shoe by Rubbing with Match Head

TO REMOVE paint spots from shoes, I have used on several occasions a trick learned from a bootblack. The spot is merely rubbed firmly with the head of an ordinary wooden match of the kind that can be struck anywhere (not a so-called safety match). Do not rub so hard that you ignite the match because that would burn the finish off the leather. If the spot is stubborn, moisten it with a little water and repeat the rubbing. The method has never failed me so far with any kind of paint spot, although it will not, of course, remove a stain.—C. A. VOELCKEL.

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Can "Frozen Sleep" Cure Cancer?

(Continued from page 46)

license for awakening their characters, like Rip Van Winkle, years or centuries later.

One of the foremost of living biologists, Dr. Alexis Carrel of the Rockefeller Institute for Medical Research, made newspaper headlines some time ago when he suggested that a way might be found to dry up people like the dehydrated, puckered-up vegetables you may buy at your grocery store—and then resuscitate them at a later date! But he took pains to point out that a microscopic eight-legged aquatic creature called the tardigrade was the highest animal upon which the experiment had succeeded so far.

Much farther up the evolutionary scale come fish, frogs, and other animals that have been frozen in the laboratory and then revived, none the worse for the experience. Experiments like these have inspired fanciful proposals. One of the strangest was to explore the ice fields of northern Siberia in the hope of finding a mammoth embedded in the ice, so that scientists could attempt to bring this prehistoric creature back to life.

Nearly 200 persons actually offered themselves as subjects, not so long ago, when a California experimenter sought a human volunteer to be frozen alive! He maintained that he had frozen monkeys solid, kept them in a refrigerator for days, and then revived them. Scientists remained skeptical of his claims, and civil authorities forbade the proposed test on a human subject.

The latest "frozen sleep" experiments began in a much less spectacular way, when Dr. Fay and Dr. Smith tried out an improved technique for treating cancer locally with cold applications. From a tank resembling a clothes washer, filled with water and ice and set beside the patient, a motor-driven pump circulated ice water through a cooling coil resting on the patient's skin. A thermometer registered the temperature of the water as it returned to the reservoir. This "refrigeration" treatment, as the experimenters called it, gave promising results and immediate relief from pain. But some types of cancer were too deep-seated to be affected by the cooling coil. So the experimenters took the bold step of lowering the temperature of a patient's whole body in what they call their "hibernation" treatment, using frozen sleep to attack a malignant growth that could be reached in no other way. After the sensation created by the announcement of their first successes, they have drawn a protective veil of secrecy about their experiments, while they pursue their extraordinary line of research.

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How Will the World End?

(Continued from page 58)

in a sparsely settled region of Siberia. The accompanying blast of air flattened forests, bowled over persons 100 miles away, and circled the earth twice before all its force was spent. Suppose a few hours' difference in time had brought the fireballs down in Leningrad, Stockholm, or Copenhagen!

A more certain finish, although lying billions upon billions of years ahead of us, is freezing. Feeding upon itself to create energy, the sun is constantly losing weight. Sooner or later it will be completely burned out—a dead power plant.

As that time approaches, the sun will become a dull-red ball in a sullen sky, casting only a feeble, ruddy glow over ice that will cover the earth. For a time, human beings will be able to live near the equator, and then underground, beside perpetually burning fires. But when the solar furnace dwindles to a faint spark, the earth's atmosphere will turn to liquid air and life will become impossible.

Another event will make doubly certain of the world's end, in the almost inconceivably distant future. As tidal friction slows down the moon in its orbit, the earth will draw it nearer and nearer. To anyone still on earth, it will appear as an ominous golden-orange orb, fattening in apparent size until it reaches twenty-four times its present magnitude—no longer a friendly beacon by night, but a terror in the skies.

Its approach will set up terrific tides in the earth's seas. At high water, the oceans will wash over all but the highest mountains. Racking strains in the earth's crust will unleash the inferno that lies beneath, and volcanoes will spew smoke, lava, and poisonous gases into the air.

Finally the moon will get too close. The earth will set up irresistible "land tides" in its solid satellite. Since the moon cannot give, it will burst—first in two, then in smaller pieces. Some of these will rain on the earth as showers of molten meteors, completing the destruction of anything alive. The rest will revolve around the earth, forming a beautiful band of light like Saturn's rings. But no living thing will be here to see it.

There remains a more hopeful side to the picture. Man, if still the dominant creature here, clearly will have seen the planet approaching its inevitable doom. Long before the end comes, may he not have devised a way to flee—perhaps in rocket ships—to some more hospitable planet? He need not hurry his preparations; for, barring accidents, he has quite a few billions of years left to think about it and decide what to do.

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Ask for

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3-IN-ONE Oil

Gus Wins on Double Trouble

(Continued from page 140)

thing as it should be. Then he called Harry, the Model Garage's grease monkey.

"Flush out the radiator and the cylinder block," he instructed him, "and check carefully for a collapsed water hose. Then fill the radiator, and let her run for twenty minutes." He turned to the driver. "Maybe you'd better 'phone your boss," he suggested. "I'm afraid this job is going to take us the better part of an hour."

"No, I won't 'phone, thank you," the big fellow decided. "The boss gets actually violent over the wire when you have to tell him something that he doesn't like. I'll walk down the road to that diner I noticed, and have a bite to eat."

Gus went on with another job, and a half hour later Harry came over to him to report that he had carried out all his orders, and that after the truck's engine had been running for ten minutes it was doing a right nice job of overheating at 212 degrees!

Gus went over to investigate, and just then the driver came back. "Lift up the hood," Gus told Harry. He examined the fan belt again. Then he straightened up, lighted his pipe, and did some perplexed thinking. As he leaned down to feel the pressure in the upper hose he exhaled a little cloud of smoke. He stood staring for a long moment, and then blew another smoke cloud under the hood.

Instead of puffing back into his face, the smoke was drawn out through the radiator!

Gus turned to the driver. "Why the dickens didn't you tell me you've been having trouble with your fan?" he demanded. "You have, haven't you?"

"Why, yes," the big fellow admitted. "Early this afternoon. One of the blades broke and made a lot of noise, and I stopped at a little garage out in the country to have it fixed. They did a lot of fussing around, I thought, but after a half hour or so they put on a new blade, and the fan worked all right. Come to think of it, though, it wasn't long after that when I first noticed the engine heating up."

"No wonder it heated up!" Gus said. "I can tell you just what happened. Those fellows in that little hick garage didn't have a fan assembly for this particular make of truck. But they weren't going to lose a sale, so they took an old assembly from a truck of another make, and bolted it on.

"Probably they thought that it would work all right—the chances are that they didn't know enough to realize that the fan they installed on your job was designed for oppo-

(Continued on page 226)

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Gus Wins on Double Trouble

(Continued from page 224)

site rotation from your old fan. Instead of drawing cool outside air through your radiator and cooling the water, it blew air heated by the engine through your radiator the wrong way and heated the water. I didn't spot what was wrong until I saw the smoke from my pipe going out through the radiator instead of blowing right back into my face. Now I'll have Harry put on the right fan assembly, and you can be on your way."

It was just five o'clock when the big and mild truck driver climbed into his seat, waved a large hand, and rumbled away.

Joe came into the shop, grinning widely. "It's official closing time. Pay up, Gus!" he demanded. "I put one over on you that time. When I saw Tim Sheridan hauling that Screwball Special of his into the shop this morning I knew darned well that you were going to start the day with a job that wouldn't be duplicated on any regular automobile. So if you'll just oblige me by handing over that—"

Joe had picked up the time-and-material slip on the day's last job, which Gus had just finished filling out, and had been glancing over it as he talked. Suddenly he let out an outraged howl.

"What the devil's this?" he demanded. "What do you mean—repairing fan running wrong way?"

"I mean that you have lost a dollar," Gus said. "Yes, that's what that job was—fixing a fan that was running the wrong way. You needn't take my word for it. Ask Harry."

"That's what it was doing," Harry corroborated. "Gus spotted the trouble when—"

"Oh, I don't care a darn when he spotted it!" Joe said disgustedly, forking over a dollar bill. "Some day, Gus," he threatened, "I'm going to get you—good and hard!"

"Maybe—maybe," Gus said soothingly. "That'll be the same day that automobiles stop doing screwy things!"

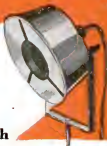
"Liquid Coal" Drives Car

FINELY pulverized coal, suspended in an oil carrier, was the fuel used to run an automobile in a demonstration given recently at Chicago by Dr. Francis W. Godwin, director of the coal research division of the Armour Institute of Technology's research foundation. The car, a standard 1939-model sedan, was unchanged except for the removal of a fine-screen filter from the fuel system. Gasoline was used for starting the car.

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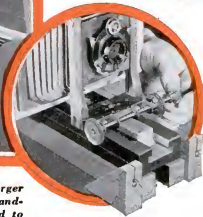
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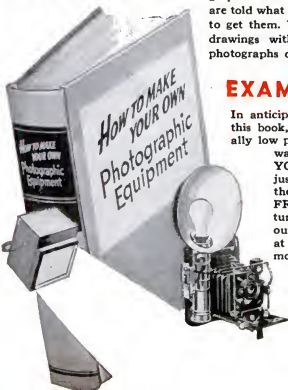
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(Continued from page 191)

and grow in search of an egg cell, just as they would on the stigma of a flower pistil.

The microscopic study of pollen grains has a practical side. Most honey contains them, and with a microscope an expert can tell accurately from what flowers a certain specimen of honey was made. Paleobotanists have, with microscopes, traced through many centuries the history of plant life in swampy regions by studying the pollen grains found in muck and peat deposits. Pollen grains are very durable, and are preserved in practically their original state in such swamps. They are even found in coal, and have helped scientists to identify the plants from which the coal was made. Pollen grains in coal are pressed out into thin disks that appear yellow under the microscope. The oil they contain contributes to the burning qualities of the coal.

So you see that your hay fever can be tied in an interesting way to your microscope, for it is the various kinds of pollen filling the summer air that cause irritation of the membranes of the noses of susceptible persons. Atmospheric pollen grains are usually collected by exposing for several hours a microscope slide having a spot coated with a thin layer of glycerin jelly. Bits of dust, lint, and soot are removed from the jelly, and the preparation protected with a cover glass.

To make glycerin jelly for mounting specimens such as pollen grains that contain some moisture, get a half ounce of dry gelatin from the drug store, place it in a granite pan or dish, and cover it with cold water. Let it stand an hour or so, until the gelatin is soft. Drain off the water and warm the gelatin over a water bath (as with a double boiler) until it melts. Stir a small amount of white of an egg, about three cubic centimeters, into the gelatin and continue heating for twenty minutes or so. Do not heat beyond 175 degrees. The albumen precipitates out, carrying dirt with it. Filter the gelatin while hot through cloth that does not shed lint, mix with glycerin of equal volume, and add as a preservative about three grams of chloral hydrate.

To use, warm the glycerin jelly until it is fluid, place on the slide, which preferably should be warm too, and be careful to include as few bubbles as possible when you put the cover glass in place.

Hollow-ground slides can be purchased from supply houses. If you have none in which to germinate pollen, try cementing a ring of celluloid, shellac-saturated cardboard, or a brass washer to a slide with shellac or balsam, to form a hollow cell.

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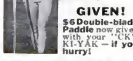
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Fun with the Halogens

(Continued from page 195)

about ten grams (two teaspoonfuls) of bleaching powder in 100 cubic centimeters (three and a half fluid ounces) of water, and filtering to obtain a clear solution. Or you can use the straight, undiluted solution of sodium hypochlorite sold under various trade names at drug and grocery stores, for bleaching and for whitening clothes.

Half fill three test tubes with either of these hypochlorite solutions. To one tube, add about five cubic centimeters (a teaspoonful and a half) of a dilute solution of copper sulphate. To the second tube, add some ferrous (iron) sulphate. To the third tube, add five cubic centimeters of copper sulphate solution and an equal quantity of ferrous sulphate solution. Shake each tube and let them stand.

Soon you will see gas bubbles forming in the third tube, containing both copper sulphate and iron sulphate, although there will be practically no evolution of gas in the two other tubes. The gas is formed by the decomposition of the hypochlorite solution. Insert a glowing straw in the third test tube, and it will flare up and burn with a vivid light, showing that the gas is oxygen. Here is an instance in which two substances, neither of which could be considered a catalyst alone, do a nice bit of teamwork as catalysts when placed together.

POPULAR SCIENCE Question Bee

BELOW are the correct answers to the Question Bee on page 134. Compare your results with the list below and give yourself five points for each one you had right. A total score of 75 to 85 is good; 90 or better is excellent.

- | | | | | |
|------|------|-------|-------|-------|
| 1. c | 5. b | 9. d | 13. c | 17. d |
| 2. c | 6. b | 10. b | 14. c | 18. c |
| 3. d | 7. b | 11. a | 15. b | 19. b |
| 4. b | 8. c | 12. b | 16. d | 20. f |

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With the Inventors

A TRUCK MOTOR equipped with an ingenious device credited to Max K. Golden, of Detroit, Mich., shuts off automatically when the driver leaves his seat in the cab. Unless interrupted by the body of the driver, a beam of light from a lamp at the back of the cab falls on a photo-electric cell placed in a dashboard control box, which causes a mag-



netic device to break the ignition circuit and switch off the motor. In case of any highway accident in which the driver leaves or is thrown from his place, the unit instantly shuts off the motor. A counting mechanism attached to the device records the number of times the driver leaves his seat during a day's run, thus permitting a check on his movements while on duty . . . IF AN APPLICANT FAILS to continue negotiations for his patent in some manner within six months after the date when the last official notice of any action by Patent Office authorities was mailed to him, his application will be held to have been abandoned . . . A WINDOW SHADE that can double for draped curtains is the contribution to home decoration made by George F. Brent,

a Pittsburgh, Pa., inventor. Divided part way up the center by a slide fastener, the window shade is wound around a roller at the top and can be pulled up and down like any ordinary shade. But when split up the middle by opening

the slide fastener, the two parts of the shade may be draped back against the sides of the window to serve as curtains . . . INVENTORS OF INDEPENDENT IMPROVEMENTS on the same machine cannot

obtain a joint patent for their inventions. Each must patent his own improvement separately . . . YOU SHOULD HAVE

(Continued on page 235)

NO TROUBLE whatsoever finding the place where you left off reading a book if you use the novel bookmark invented by Rebecca Cohen, of Brooklyn, N. Y. Clipped onto a book



as well as the precise page and line . . . "PRODUCTION OF SURROGATES and Additions for Coffee" is this month's contribution to the growing list of unusual patent titles. "Surrogate," in this meaning of the word, has no reference to judicial officers. In this case it means "substitute." . . . WALNUT HARVESTING IS SPEEDED UP by means of a portable tree shaker invented by Joseph Berger, of Covina, Calif. After spreading canvas sheets on the ground around a

tree to catch the nuts, the machine, mounted on a truck or tractor, is backed up near the tree, and an extension boom raised so that a padded saddle on one end engages a main branch. An electric-powered reciprocating mechanism then vibrates the boom, which effectively shakes the tree limb and starts a cascade of nuts down onto the canvas collecting sheets



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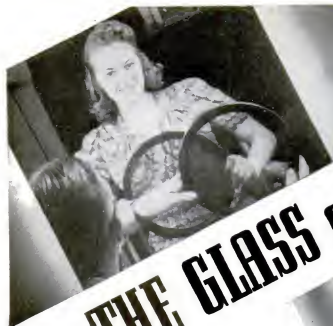
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With the Inventors

(Continued from page 232)

commercial use . . . INSTEAD OF RAPIDLY THUMBING the page edges of a picture book to produce an animated movie from a series of still pictures, a toy devised by A. R. Bunting, of Portsmouth, Va., utilizes a blowpipe to whirl fan blades bearing photographs or sketches. Mounted in a wire framework, a revolving wooden hub supports projecting pic-



ture panels that whirl in the path of air blown through the pipe . . . "COUPLING WITH A PRESENT-DAY trailer hitch is a lot like threading a needle you can't see. It takes too much time and skill. Foolproof, compact units which require no great skill to operate are needed." As a direct consequence of the above statements, which appeared in an article on trailer travel published in the June 1937 issue of POPULAR SCIENCE MONTHLY, Guillermo Solomon, of Santiago, Dominican Republic, invented an improved, simplified trailer hitch that won him U. S. patent 2,150,010 . . . BOTH LIQUID AND DRY FOODS, such as milk, sugar, butter, and sirups are quickly and accurately measured with an adjustable measuring cup designed for home-kitchen use by Cecelia S. Jansen, of Los Gatos, Calif. In conventional measuring cups, the housewife fills the cup up to half, three-quarters, or other fractional levels marked by lines on the side of the container. With the new measurer, the cup is always filled to the brim, a pistonlike plunger being set according to a scale so that the cup will hold just the required amount . . . CLAIM NO. 2 IN PATENT 2,161,332 contains only three words, but the middle one is a tongue-tying



chemical whopper of the first magnitude: "A 3,3'-dialkylthiazolinotricarbocyanine salt." How'd you like to be a proof reader for the "Patent Office Gazette"?

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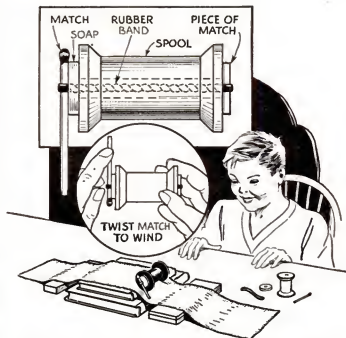
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"I work 'n Radio part time, still holding my regular job. Since enrolling seven years ago, I have averaged around \$50 every month." **JOHN B. MORISSETTE**, 809 Valley St., Manchester, N. H.

Makes \$50 to \$60 a Week
"I am making between \$50 and \$60 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N. R. I." **H. W. SPANGLER**, 124 S. Gay St., Knoxville, Tenn.



Operates Public Address System
"I have a position with the Los Angeles Civil Service, operating the Public Address System in the City Hall Council. My salary is \$170 a month." **H. H. HOOD**, City Hall, Los Angeles, Calif.



I will train you at home for many Good Spare Time and Full Time Radio Jobs

Radio offers you many opportunities for well-paying spare time and full time jobs. And you don't have to give up your job, leave home or spend a lot of money to train to get these jobs—to become a Radio Technician.

Get Ready Now for Jobs Like These

Radio broadcasting stations employ engineers, operators, station managers and pay well for trained men. Fixing Radio sets in spare time pays many \$20 to \$50 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as \$30, \$40, \$50 a week. Many Radio Technicians open full or part time Radio sales and repair businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, in good-pay jobs with opportunities for advancement. Automobile, police, aviation, commercial Radio, loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I trained have good jobs in these branches of Radio.

Why Many Radio Technicians Make \$30, \$40, \$50 a Week

Radio is young—yet it's one of our large industries. More than 25,000,000 homes have one or more Radios. There are more Radios than telephones. Every year millions of Radios get out of date and are replaced. Millions more need new tubes, repairs. Over \$50,000,000 are spent every year for Radio repairs alone. Over 5,000,000 auto Radios are in use; more are being sold every day, offering more profit-making opportunities for Radio Technicians. And RADIO IS STILL YOUNG, GROWING, expanding into new fields. The few hundred \$30, \$40, \$50 a week jobs of 20 years ago have grown to thousands. Yes, Radio offers opportunities—now and for the future!

Many Make \$5, \$10, \$15 a Week Extra in Spare Time While Learning

The day you enroll, in addition to our regular Course, I start sending Extra Money Job Sheets; show you how to do Radio repair jobs. Throughout your training I send plans and directions that make good spare time money—\$20 to \$50—for hundreds, while learning.

This Coupon is Good for One FREE Copy of My Book

J. E. SMITH, President, Dept. 9JP3 National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio," which points out the spare time and full time opportunities in Radio and explains your 50-59 method of training men at home in spare time to become Radio Technicians. (Please Write Plainly.)

NAME AGE.....

ADDRESS

CITY STATE.....

Here's How You Get Practical Experience While Learning

I send you special Radio equipment; show you how to conduct experiments, build circuits illustrating important principles used in modern Radio receivers, broadcast stations and loud-speaker installations. This 50-59 method of training—with printed instructions and working with Radio parts and circuits—makes learning at home interesting, fascinating, practical. I ALSO GIVE you a MODERN, PROFESSIONAL ALL-WAVE, ALL-PURPOSE RADIO SET SERVICING INSTRUMENT to help you make good money fixing Radios while learning and equip you with a professional instrument for full time jobs after graduation.

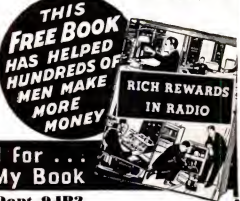
Money Back Agreement Protects You

I am so sure I can train you to your satisfaction that I agree in writing to refund every penny you pay me, if you are not satisfied with my Lessons and Instruction Service when you finish. A copy of this agreement comes with my Free Book.

Find Out What Radio Offers You

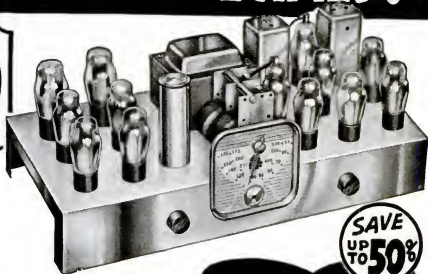
Act Today. Mail the coupon now for "Rich Rewards in Radio." It points out Radio's spare time and full time opportunities and those coming in Television; tells about my training in Radio and Television; shows you letters from men I trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL COUPON in an envelope, or paste on a postcard—NOW!

J. E. SMITH, President
Dept. 9JP3, National Radio Institute
Washington, D. C.



1940 MIDWEST FACTORY-TO-YOU 20th ANNIVERSARY SPECIALS!

WITH **TELEVISION**
ADAPTATION



14-TUBE POWERFUL MIDWEST

PUT THIS CHASSIS IN YOUR PRESENT CABINET.

HERE is what we believe is today's biggest radio value—the 1940 TELEVISION-ADAPTED Midwest. Not since 1920, when this firm was established, have we been able to offer you such a bargain. Now, you can enjoy the mighty power of 14 latest type tubes—plus an advanced circuit—plus advanced features—plus astonishing foreign performance—plus TELEVISION ADAPTATION—for little more than the cost of new tubes—and on 30 days trial in your own home.



14-TUBE
CONSOLE

only \$**29.⁹⁵**

COMPLETE
HERE IS THE
BARGAIN OF
THE YEAR—
a 14-tube radio
complete with
console, at price
you would ordi-
narily pay for a
7 or 10-tube set.

This "Twentieth Anniversary", designed - for - tomorrow radio is offered you at a sensationally low factory-to-you price—making it possible for you to modernize your old radio—with an "up-to-the-minute" model—to be prepared for the developments of tomorrow.

The many advantages and features which characterize this 1940 radio result in unusual naturalness of tone realism, in amazingly faithful reproduction, in unusual sensitivity, and hair-line selectivity. But don't just take our word for it—write for the new 1940 "Twentieth Anniversary" catalog. See for yourself the features and advantages of this and many other radios in the new 1940 TELEVISION-ADAPTED Midwest line. See for yourself why only Midwest offers Organ-Fonic Tone Filter, Organ Key Tone Control, Antenna-Scope and other exclusive features on its 17-Tube, 5-Band radios. No installation problem . . . no outside antenna . . . just PLUG-IN and play!

COMPLETE
CHASSIS

Only

\$**19.⁹⁵**

WITH TUBES
AND SPEAKER

SAVE
UP TO **50%**

30 DAYS
TRIAL

NEW
LOW
EASY
TERMS

LIBERAL TRADE-IN ALLOWANCE UP TO \$40.00 FOR YOUR OLD RADIO

The famous Midwest 30-day Trial Plan enables you to try any Midwest radio for 30 days before you make up your mind. You can trade in your old set and receive as much as \$40.00 trade-in allowance. Tell us the make and age of your present radio—so we can determine how much to allow you on it. Our new Easy-Pay Plan makes it easier than ever before to own a Midwest. Absolute satisfaction guaranteed on a money-back basis. Write today for FREE 1940 "Twentieth Anniversary" catalog.

MIDWEST *Factory-to-You* **RADIOS**

DEPT. 59-B, MIDWEST RADIO CORPORATION...CINCINNATI, OHIO, U.S.A.
Manufacturers of Quality Radios Since 1920

PASTE COUPON ON 16 POSTCARD... OR

Write Today!

MIDWEST RADIO
CORPORATION
Dept. 59-B Cincinnati, Ohio

Send me your new
FREE 1940 catalog,
complete details of
your liberal 30-day
Trial Offer. Factory-
To-You Wholesale
Prices, and big
TRADE-IN Offer.

Name.....
(PLEASE PRINT CLEARLY)

Address.....

Town.....

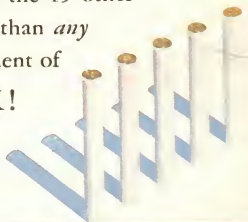
State.....

User-Agents Make Easy Extra Money.
Check Here for details.

By burning 25% slower than the average of the 15 other of the largest-selling brands tested—slower than *any* of them—CAMELS give smokers the equivalent of **5 EXTRA SMOKES PER PACK!**



**SEEING
IS
BELIEVING!**



CAMEL'S expensive tobaccos, so inexpensive to smoke—is welcome news to millions who are keen for the smoking thrill of finer tobaccos! Naturally, a slower-burning cigarette, Camel, gives *more and better* smoking for the money. And now the impartial research of a leading laboratory proves that Camels burn *far* slower than the average of the 15 other of the largest-selling brands tested. Here are 3 cigarette facts as reported by this scientific group:

- 1** Camels were found to contain **MORE TOBACCO BY WEIGHT** than the average for the 15 other of the largest-selling brands.
- 2** CAMELS BURNED SLOWER THAN ANY OTHER BRAND TESTED—**25% SLOWER THAN THE AVERAGE TIME OF THE 15 OTHER OF THE LARGEST-SELLING BRANDS!** By burning 25% slower, on the average, Camels give smokers the equivalent of **5 EXTRA SMOKES PER PACK!**
- 3** In the same tests, **CAMELS HELD THEIR ASH FAR LONGER** than the average time for all the other brands.



**SMOKING
IS
BELIEVING!**

A BATTERY OF "SMOKERS" determine the burning time of 16 of the largest-selling brands. Trained scientists and special equipment assured scientific control. Camels (shown here under test) proved 25% slower-burning than the average of the 15 other brands tested, giving Camel smokers the equivalent of 5 extra smokes per pack!



During the summer season of extra smoking—begin enjoying the cigarette of *extra smokes!* Everyone can afford the coolness, the true mildness, the ripe, delicate taste and fragrance of smoking pleasure at its best. *More* smoking for your money, and the added bonus of Camel's *costlier tobaccos*. Try Camels—America's favorite and *libriest* way to true smoking enjoyment!



THE CIGARETTE
OF
**COSTLIER
TOBACCOS**

*Penny for penny
your best
cigarette buy!*

Copyright, 1939
R. J. Reynolds Tobacco Co.
Winston-Salem, N. C.